total earth care

Biodiversity Development Assessment Report (BDAR)

Allambie Heights Village

3 Martin Luther Place, Allambie Heights 2100

Total Earth Care Pty Ltd

July 18

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Table of Contents

Table of Tables

Table of Figures

Executive Summary

The Development Proposal was assessed under the Biodiversity Assessment Method (BAM) in order to produce this required Biodiversity Development Assessment Report. The proposed development footprint has effectively used the “avoid and minimise” principles so that the residual impact on biodiversity is largely confined to a small amount of clearing of native vegetation along the western boundary of the proposal for the fire APZ. Although APZs can be managed as a low growing native plant community, the removal of the existing vegetation structure must be used in the clearing area calculations. Of the three types of native plant communities identified on the whole subject site, only two (2) would be subject to clearing along the development boundary. The very small area to be cleared (.03ha) approximately results in the minimum offset credit requirement of one (1) credit for each of these communities. The small size of the cleared area was insufficient to trigger any credit requirements for threatened fauna species even though a range of predicted “ecosystem credit species” were assumed to be present and one (1) ”species credit species” – The Eastern Pygmy Possum was identified.

Stage 1: Biodiversity Assessment

1 Introduction

1.1 Background

Total Earth Care (TEC) has been commissioned by Allambie Heights Village to prepare this Biodiversity Development Assessment Report (BDAR) for the development proposal at 3 Martin Luther Place, Allambie Heights 2100. The subject site is within the Northern Beaches Council Local Government Area.

1.1.1 Requirement for BDAR under the Biodiversity Conservation Act 2016

The requirement for a BDAR is triggered by the occurrences of land on the subject site mapped as having high biodiversity value by the Biodiversity Conservation Regulations 2017. Although the area to be cleared is small (less than 1ha), the presence of an area of high biodiversity precludes the use of the streamlined assessment under the BAM.

This BDAR will be written in accordance with the *NSW Biodiversity Conservation Act 2016* (BC Act 2016) and supporting documents.

The BDAR will:

- Assess in accordance with the Biodiversity Assessment Method (BAM) (OEH 2017) the biodiversity values of the land subject to the proposed development, activity or clearing;
- Assess in accordance with the BAM the impact of proposed development, activity or clearing on the biodiversity values of that land;
- Set out the measures that the proponent of the proposed development, activity or clearing proposes to take to avoid or minimise the impact of the proposed development, activity or clearing, and;
- Specify in accordance with the BAM the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values of the actions to which the Biodiversity Offsets Scheme (BOS) applies.

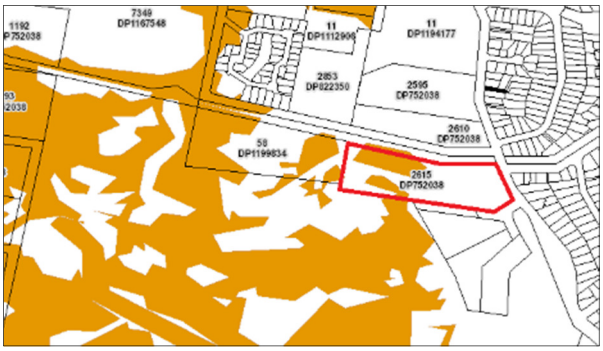


Figure 1. Extract from the current Biodiversity Values Map showing areas of high biodiversity value in relation to the outlined subject lot, DP 752038

1.2 Description of the development site

Allambie Heights Village has leased a 3.72ha property at 3 Martin Luther Place, Allambie Heights (the subject land). A master plan has been produced by AHV with the intention of building a retirement village adjacent to its aged care facility, Allambie Heights Village, at Martin Luther Place. The development will be a state-of-the-art assisted living village infrastructure precinct which will augment its current capacity and service the burgeoning need for aged care and assisted living. The site is currently being used as a Residential Aged Care Facility, however the western end of the property has not been fully developed and a significant portion of the site is remnant bushland.

The site is zoned as R2 Low Density Residential and is contiguous with the Manly Warringah War Memorial Park which is a 375ha passive and active recreational bushland park located on the western

and southern boundaries of the subject land (Warringah Council LEP 2014). The northern boundary adjoins a Sydney Water reticulation pipe and bushland easement. The Allambie Heights Village has a common boundary on the subject land's southern boundary.

It should be noted that the remnant bushland section of the site has been partially developed by the past lessee. A sealed road has been built on cut and filled soil through the centre of the site. Two drains have been excavated into solid rock which have created de-facto creeks. Walking tracks have also been installed and parts of the site have been cleared and burned.

See Map 1 for the Site Map and Map 2 for the Location Map.

1.2.1 The proposed action/s and footprint

The proposed development site footprint is restricted to the areas of the subject site containing the lowest biodiversity values. These areas are located to the eastern and central parts of the site. The development site footprint will partially extend a short distance into native vegetation as a bushfire APZ and drainage line rehabilitation, resulting in the clearing of 300m^2 of vegetation.

The proposal plans used for this assessment are:

- Site Plan – Allambie Heights Village, Project No. 2017019, Drawing No. DA-011, Issue A, Jackson Teece Approved and Generated 06/07/2018
- APZ Diagram, Allambie Heights Village, Project No. 2017019, SK-101, Jackson Teece. Generated 16/05/2018
- Stormwater Management Plan, Allambie Heights Village - Project 2, Project No. 38509-CI-RE_001, Wood & Grieve Engineers, prepared by Ian Harris, for Allambie Heights Village Pty Ltd, dated 18 June 2018

The proposed development site footprint consists of three (3) buildings. Building A and Building B are to be units for independent living, and another building will house a swimming pool. Building A and B will be situated approximately west of the existing buildings on site, with Building A on the northern half of the site, and Building B at the southern half, and will be to the north of the existing road which runs approximately east to west and adjoins Martin Luther Lane. Two (2) visitor parking areas are also proposed along the southern side of this existing road. The proposed swimming pool building will be to the south-west of building B, on the other side of the existing road. A vehicle access way will run from the space between building A and B and join the existing road to the north of the swimming pool building. A bushfire emergency access path will run along the north of building A and join the proposed vehicle access way. A services easement will run approximately east to west in line with the existing road.

See Map 1 for the operational footprint.

1.2.1.1 Tree Removal

Summary of tree removal works

In summary, one hundred and seven (107) trees were assessed for this development and 85 trees were recommended for removal as they are either:

- within or immediately adjacent to the construction footprint and unable to be retained due to impacts from construction, installation of services, bulk earthworks and regrading;

  OR,

- are considered weeds or in poor, or very poor, condition and unsuitable to be retained in the context of the development.
- Twenty-two (22) trees are to be retained and protected.
- Twenty (20) have nil or minimal foreseeable impact from construction related activity; and,
- Two (2) have minor encroachments as defined under AS 4970 – 2009;

The largest and most prominent tree on the site is a large Sydney Blue Gum (*Eucalyptus saligna*) (T55). It is clearly visible from Allambie Road and other public areas. A similar tree to its west is in poor health and condition and its removal has been recommended in the arborist report. T55 is to be retained and protected with only a minor incursion to its south-west. Building placement and landscaping has been tailored to minimise impacts to this tree during construction. It is not 'naturally' occurring to this particular site but it will create a valuable landscape asset and will help screen and separate the new development from Allambie Heights Village. At the time of the last tree inspection report (2018) it is in good health with minimal observable defects.

1.2.2 Definitions used in this report

This report uses the following key definitions:

- **Subject Site (the Site)**: refers to the area of land likely to be directly or indirectly impacted by the proposed action.
- **Development site**: refers to the area that will be directly impacted by the proposed action.
- **Study Area**: comprises the subject site in addition to the surrounding land that may be potentially indirectly affected by the development or affect the development
- **Locality**: encompasses a larger area that includes neighbouring properties and includes areas of native biodiversity values nearby.

These definitions are written in line with the BAM methodology, which provides further explanations of definitions and legal terms that may be used in this report.

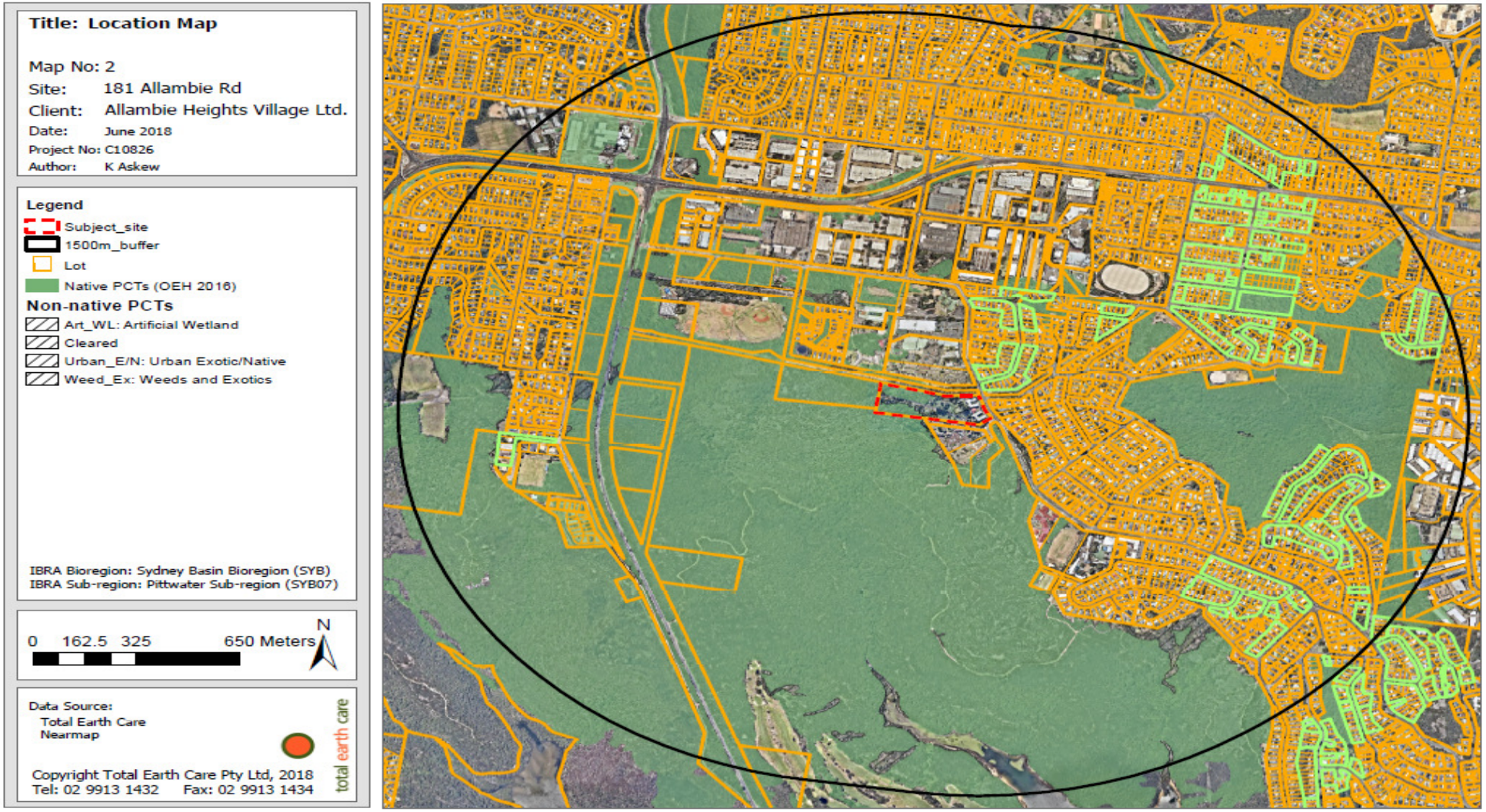
1.2.3 Information sources

The following databases and Geographic Information System (GIS) layers were searched/obtained for use the assessment:

- BioNet Atlas Search Tool (OEH 2018a)
- BioNet Vegetation Classification Tool (OEH 2018b)
- Development Constraints Report: Allambie Heights Village, Allambie Heights (TEC September 2017)
- eSPADE 2.0 (OEH 2018)
- Native Vegetation of the Sydney Metropolitan Area version 3.0 (OEH 2016)
- NSW Wetlands Spatial Data (OEH 2011)
- SEPP 14 Coastal Wetland Map (OEH 2017)
- Vegetation Management Plan: Allambie Heights Village, Allambie Heights (TEC 2017)
- Waterways Impact Statement: Allambie Heights Village Project 2 (TEC 2018)
- Warringah Creek Management Study (Warringah Council 2004)
- EPBC Protected Matters Search Report

Map 1. Site Map

Map 2. Location Map



2 Landscape Features and Site Context

2.1 Site context

2.1.1 IBRA bioregions and Subregions

The subject land is located within the Sydney Basin Bioregion (SYB), Pittwater Sub-region (SYB07), and the Belrose Coastal Slopes NSW landscape region (Mitchell landscapes).The Estuary/Water Added Mitchell landscape is present to the south of the 1500 m buffer due to the presence of Manly Reservoir.

The subject land has an area of 3.72ha.

2.1.2 Native vegetation extent

There is 388.48ha of native vegetation within the 1500 m buffer area surrounding the outside edge of the boundary of the subject site. This represents 48.3% of the total buffer area (804.15ha) and falls within the >30-70% native vegetation class.

See Map 2. Location Map for native vegetation extent.

2.1.3 Cleared areas

The subject land contains 2.05ha of extant cleared areas (See

Map 3: Cleared Areas Extant). The cleared areas include the existing buildings and garden areas and the access road bisecting the site in an approximately east to west direction. The lower verge of the road is formed from a fill batter that is topped with an exotic lawn. This lower slope of road fill is covered in a high density of exotic weeds. The managed lawn area is bounded to the west by the artificially created drainage line. A walking track/4WD track runs through the south western corner of the site and were probably created for access for the power lines running just outside the property boundary.

Managed open areas of the Eastern half of the site, looking west.

2.2 Landscape features

A summary of site information and landscape features is below in Table 2-1.

Table 2-1. Site information for BAM

Category	Details
Interim Biogeographic Regionalisation for Australia (IBRA)	Sydney Basin
IBRA Sub Region	Pittwater
NSW Landscape	Belrose Coastal Slopes
% Native vegetation cover	30-70% (within 1500m buffer zone)
Landscape features	
Rivers and streams	Two (2) small artificial drainage lines, which only flow after rains and do not hold standing water.
Wetlands	None
Connectivity features	Contiguous with bushland of Manly Warringah War Memorial Park
Areas of geological significance and soil hazard features	None
Areas of Outstanding Biodiversity Value identified under the BC Act	None

2.2.1 Rivers and streams classified according to stream order

Within the subject land two drainage lines have been artificially excavated into sandstone bedrock and have created de-facto creeks (see Map 1). These artificial creeks are not mapped by the Office of Water

as streams recognised by the Strahler System (i.e. they do not appear as blue lines on a 1:25,000 topographic map as held by the Land Information Centre). The creekline to the west of the site is approximately 80m long and the creekline in the centre of the site is approximately 60m long. Both creeks flow in a north-south direction.

The central creekline is mapped as forming part of the upper headwaters of Curl Curl Creek within the Manly Creek sub-catchment (Warringah Creek Management Study 2004). Northern Beaches Council have determined the beginning of Curl Curl Creek does begin on site at the culvert below the existing road.

The River Styles of both of these creeklines is "urban modified", meaning their channels have been modified to the extent that they no longer function as rivers (WCMS 2004). The creeks function as open drainage lines to transport the flow of stormwater (see Figures 2.1 and 2.2). They are both ephemeral and only flow after rain events.

The vegetation along the creeklines is not distinctly riparian in contrast with the surrounding bushland. An artificial detention basin is located below the eastern creekline and is sparsely vegetated with riparian species.

Figure 2-1. Western creekline during flow event

Figure 2-2. Central creekline dry

2.2.2 Wetlands within, adjacent to, and downstream of the site

There are no wetlands located within or adjacent to the subject land. However, Manly Reservoir is located approximately 1.2km downstream of the site and is classified as a wetland according to the NSW Wetlands dataset (OEH 2011).

Manly Reservoir is not listed in the Directory of Important Wetlands of Australia (DIWA) and does not correspond to a SEPP 14 Coastal wetland. As such, it is defined as a local wetland for the purposes of the BAM.

See Map 2 for wetlands.

2.2.3 Connectivity features

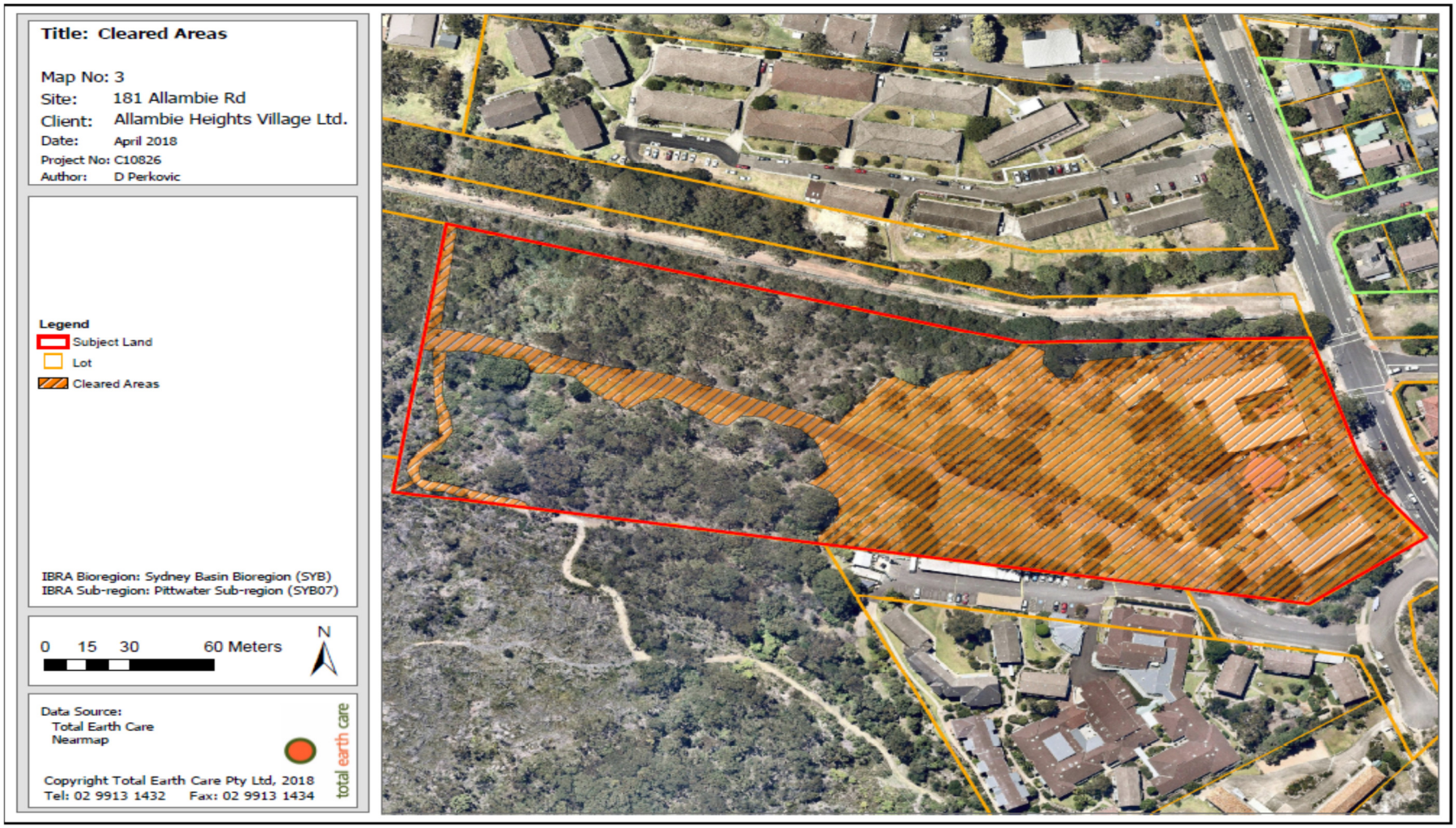
The subject land is contiguous with the Manly Warringah War Memorial Park which is a 375ha park located on the western and southern boundaries of the subject land, 78% of which is bushland. The northern boundary adjoins a Sydney Water reticulation pipe and bushland easement. Other areas of bushland situated in the locality include Allenby Park approximately 450m to the east, Goroka Park approximately 480m to the north east, and Garigal National Park approximately 1km to the south west. There are high levels of connectivity with other areas of bushland to the south and west of the subject land and poor connectivity to the north and east due to urban development.

For the connectivity of different areas of habitat that may facilitate the movement of threatened species across their range, see the Location Map (Map 2. Location Map).

2.2.4 Areas of geological significance and soil hazard features

There are no karsts, caves, crevices, cliffs or other areas of geological significance within the subject land or within the assessment area surrounding the subject land. No soil hazard features are mapped within the subject or buffer area including Acid Sulphate Soils.

Map 3: Cleared Areas Extant



3 Native Vegetation

3.1 Survey methods

3.1.1 Vegetation integrity survey

3.1.1.1 Stratification

As per the BAM, native vegetation must be stratified into Vegetation Zones. A *vegetation zone* means an area of native vegetation on the subject land that is the same Plant Community Type (PCT) and has a similar broad condition state (OEH 2017). The site was initially stratified using the most recent vegetation mapping (listed above), aerial photos of the site, and condition based on local knowledge.

Subject site and study area mapping was then ground truthed by random meander transects and plot based surveys. Any mapped vegetation outside of the study area was not field verified with data.

3.1.1.2 BAM plots

The PCT survey was completed using BAM plots within each vegetation zone. The minimum number of BAM plots was determined using Table 4 of the BAM (OEH 2017).

3.1.2 Vegetation classification and mapping

After reviewing the most up-to-date mapping, aerial photography, and completing BAM plots, the data of each BAM plot was compared to the:

- Definitions under the relevant final determination under the BC Act or conservation listing advice under the EPBC Act if available;
- Sydney Metropolitan Catchment Management Authority Community Descriptions
- NSW Plant Community Type profiles accessed for BioNet VISMap

3.2 Survey effort

3.2.1 Survey effort and timing

The survey was conducted by two (2) TEC Ecologists over 24 person-hours from February - March 2018.

Table 3-1. PCT Survey effort

Survey Dates	Survey Methods
16/03/2018	***Plant Community Type survey*** – five (5) BAM plots and 'Random meander' The following information was collected at each of the vegetation plots: • Observers, location and date, • Plot dimensions and orientation • Photographic record of vegetation • Vegetation class and plant community type (PCT) • Physical features and disturbance history • Full flora list • Growth form, cover and abundance of each species • Exotic and high threat exotic plant cover • Number of large trees • Recruitment of canopy trees • Presence of hollow-bearing trees; • Length of Logs; and; • Litter cover. The field data collected was tallied and input into the BAM calculator to determine a vegetation integrity score for the vegetation zones.

3.3 NSW Plant Community Types and site description

Three (3) native Plant Community Types (PCTs) were identified on the site. See Map 5 for native vegetation extent within the development site (as described in Section 5.1).

OEH (2016) map the subject site as containing three (3) native NSW Plant Community Types including:

- PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion
- PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast
- PCT 1824: Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin

Areas of Urban Exotic/Native vegetation, and Weeds and Exotics are also mapped within the development site.

3.3.1 Evidence to support identification of NSW PCTs onsite

The PCTs identified were those mapped on the subject site under OEH vegetation mapping, however ground survey found different locations and the extent of these communities. The plant species identified during the plot based surveys was tested against OEH Native Vegetation Profiles Version 3's bench mark figures for these communities. The results are presented in Table 3.2 below. The poor native species diversity identified in Plot 1 confirmed the mapped area as urban exotic/native. In the remaining native vegetation communities the total native species numbers tended to be below the expected numbers except for the Red Bloodwood Forest in plot 3. The best fit based on positive diagnostic species was in agreement with ground observation except for plot 3 in the Red Bloodwood Forest. This community was seen as the best fit based on both the overall community structure and topography of the zone. This area north of the access road is relatively level and dry and the dominant canopy species includes a number of scribbly gums and a relatively open canopy is more in keeping with the structure of PCT 1783

Given the relatively small size of the vegetation zones, some intergrade between communities is likely to have been picked up despite best efforts to locate the plots within distinct communities.

Table 3-2. BAM plot floristics compared with positive diagnostic (PD) species in each PCT

PCT	OEH Veg Map Code	Total species required in 0.04 Ha	Total PD species required	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
1824	**HL08 PD**	**42**	**31**	6	27	26	16	20
1250	**DSF09 PD**	**45**	**32**	6	18	26	13	22
1783	**DSF 11 PD**	41	27	6	22	25	14	17
	Total number of species			**51**	**37**	**46**	**27**	**46**
	Total number of native species			**28**	**36**	**45**	**26**	**42**
	Total number of introduced species			**23**	**1**	**1**	**1**	**4**

Plot PCT determined using all survey evidence.

3.3.2 PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest

PCT 1250: 0.39ha

The access road bisecting the remnant bushland was built along the slope transition, with the increase in slope below the road facing south providing a less sun-exposed aspect. Much of the PCT south of this road was determined to be Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (PCT 1250). The extant floristics and topography indicate that PCT 1250 extends further west than was mapped by OEH.

Figure 3. Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on site.

Table 3-3. PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest

Category	Type
Vegetation Formation (Keith 2004)	Dry Sclerophyll Forests
Vegetation Class (Keith 2004)	Sydney Coastal Dry Sclerophyll Forests
BAM PCT Number and Common Name under BioNet Vegetation Classification (OEH 2018)	1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion
Estimated percentage cleared	PCT 1250: 30% cleared
EPBC Act 1999	Not listed under the EPBC Act.
BC Act 2016	Not a Threatened community under the BC Act.
SMCMA v3 (OEH 2016) Name	S_DSF09 Coastal Sandstone Gully Forest.

Canopy species found include *Corymbia gummifera*, *Eucalyptus haemastoma*, *E. punctata*, and *E. sieberi*, with a subcanopy of *Angophora crassifolia* and *Banksia serrata*. Prominent midstorey species include *Hakea gibbosa*, *Acacia longifolia*, *Lasiopetalum ferrugineum*, and *Leptospermum polygalifolium*, while prominent groundcovers include *Imperata cylindrica, Anisopogon avenaceus*, *Lomandra* spp., and *Entolasia* spp. Minor infestations of weeds such as *Lantana camara*, *Senna pendula* var. *glabrata*, *Ochna serrulata*, and *Ehrharta erecta* are also present, especially near the western boundary of the

mapped community where a change in hydrology is evident due to a slope and drainage. The northern extent of this PCT is the exotic weed covered embankment of the road verge which has not been included in the communities calculated area.

This vegetation zone was being prepared for an ecological burn and has recently had most midstorey species cut and laid on the ground as fuel which will have some bearing on the PCTs vegetation integrity score.

Figure 3-4. Plot 5 Stat

Figure 3-5. Plot 5 End

3.3.3 PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest

PCT 1783: 0.34ha

The central section north of the access road was not found to be consistent with the mapped community of Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (PCT 1250). The extant floristics and the drier flatter topography indicate that the area is Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (PCT 1783).

Canopy species include *Corymbia gummifera*, *Eucalyptus haemastoma*, *E. sieberi*, and *E. capitellata*, while subcanopy species include *Angophora crassifolia* and *Banksia serrata*. Mid layer species in this area have been largely removed as a fire management measure, though some still remain including *Hakea* spp., *Persoonia* spp., *Boronia* spp., *Lambertia formosa*, and *Hemigenia purpurea*. Groundcovers include *Anisopogon avenaceus*, *Entolasia* spp., *Epacris pulchella*, *Hibbertia aspera*, *Lindsaea linearis*, and *Lomandra* spp., amongst others. These floristics as well as the elevated position in the landscape are consistent with PCT 1783 rather than with PCT 1250.

Figure 6 - Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on site.

Table 3-4. PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest

Category	Type
Vegetation Formation (Keith 2004)	Dry Sclerophyll Forests
Vegetation Class (Keith 2004)	Sydney Coastal Dry Sclerophyll Forests
BAM PCT Number and Common Name under BioNet Vegetation Classification (OEH 2018)	1783 Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast

Category	Type
Estimated percentage cleared	PCT 1783: 30% cleared
EPBC Act 1999	Not listed
BC Act 2016	Not listed
SMCMA v3 (OEH 2016) Name	Sydney North Exposed Sandstone Woodland S_DSF11 27 positive diagnostic species were recorded in the 0.4 ha survey plot and provided the best match among locally mapped communities. .

Extensive track clearing in this zone is apparent in satellite imagery from at least 2005. Despite this, the current bushland has almost totally regenerated and very few weed species are present. However, a change in the hydrology immediately to the west has led to a total infestation by weeds such as *Paspalum quadrifarium*, *Ageratina adenophora*, *Senna pendula* var. *glabrata*, and *Zantedeschia aethiopica*. The almost complete loss of all native strata makes this area of weeds inconsistent with either of the bordering plant communities. See Figures 3-7 to 3-8 below.

Figure 3-7. Plot 3 Stat

Figure 3-8. Plot 3 End

Figure 3-9. Weed infestation to north-west of site due to altered hydrology. Note distinct boundary between resilient woodland and weed infestation.

Figure 3-10. Weed infestation to north-west of site due to altered hydrology.

3.3.4 PCT 1824: Mallee - Banksia - Tea-tree - Hakea heath-woodland

PCT 1824: 0.76ha

This community was identified on shallow soils on sandstone benches in two locations on the northern side of the central access road. OEH mapping had the vegetation immediately west of Plot 1 mapped as Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion (PCT 1250). However, the extant floristics and geological features indicate that these areas are Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin (PCT 1824). See Map 5 for ground-truthed vegetation mapping.

Figure 11. Mallee - Banksia - Tea-tree - Hakea heath-woodland on site.

Table 3-5. PCT 1824: Mallee - Banksia - Tea-tree - Hakea heath-woodland

Category	Type
Vegetation Formation (Keith 2004)	Heathland;
Vegetation Class (Keith 2004)	Sydney Coastal Heaths;
BAM PCT Number and Common Name under BioNet Vegetation Classification (OEH 2018)	1824 - Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin
Estimated percentage cleared	10% cleared
EPBC Act 1999	Not listed as threatened

Category	Type
BC Act 2016	Not listed as threatened
SMCMA v3 (OEH 2016) Name	Coastal Sandstone Heath-Mallee S_HL08 The survey plot in this community found 27 positive diagnostic species. This community is closely aligned with S_DSF11 but in this case was found on shallower soils and a low density of canopy trees.

Prominent canopy and midstorey species include *Angophora hispida*, *Allocasuarina distyla*, *Banksia ericifolia*, *Leptospermum spp.*, and *Hakea spp*. Diverse native groundcovers include *Cyathochaeta diandra*, *Bauera rubioides*, *Actinotus minor*, *Dampiera stricta*, *Micromyrtus ciliata*, and *Epacris* spp., amongst others. An impervious sandstone shelf underlying the area has resulted in skeletal sandy soils and boggy conditions in parts. These features are consistent with PCT 1824 rather than with PCT 1250.

This area is being prepared for an ecological burn and has recently had most midstorey species cut and laid on the ground as fuel. Extensive track clearing is apparent in satellite imagery from at least 2005. Despite this, the current bushland demonstrates high resilience and very few weed species are present.

Plot 2 was placed in this zone to capture data on the integrity of this community.

See Figures 3-10 and 3-11 below.

Figure 3-12. Plot 2 Stat

Figure 3-13. Plot 2 End

A separate occurrence of this community was mapped in the north western section of the subject site and was the location of plot 4. The plot based floristics and structural elements of the plot data was consistent with this mapping. Besides several emergent *Eucalyptus haemastoma* and *Eucalyptus capitellata*, the area was dominated by a midstorey of close-growing *Leptospermum squarrosum*. Other midstorey and groundcover species included *Leptospermum polygalifolium*, *Hakea* spp., *Banksia* spp., *Xanthorrhoea media*, and *Thysanotus juncifolius*. A strip of recently slashed vegetation running north-south along the property boundary line below the powerlines can be seen in the photographs of plot 4.

Figure 3-14. Plot 4 Start (note slashing)

Figure 3-15. Plot 4 End

3.3.5 Non-native PCTs

Urban Exotic/Native

The vegetation to the north and centre of the study area is mapped by OEH as Urban Exotic/Native (Urban_E/N) and is heavily disturbed from previous clearing and weed invasion. The northern boundary of the site is managed as a Sydney Water Easement and features informal tracks and a drainage line. Evidence of rabbit grazing and mowing is apparent in the turfed lawn areas. Some native vegetation is present in this area, primarily of canopy species. Plot 1 was placed in this zone to better assess for the presence of a native PCT

Remnant canopy species include *Glochidion ferdinandi* and senescent *Acacia parramattensis*, mostly along the Sydney Water Easement boundary. Subcanopy species include senescent *Kunzea ambigua*, *Pittosporum undulatum*, and *Banksia serrata*. The mid and ground layers are composed of a mix of exotic and native species, most notably *Lantana camara*, *Eragrostis curvula*, *Imperata cylindrica*, *Acacia longifolia*, *Stenotaphrum secundatum*, and *Paspalum* spp. Survey and plot based data is consistent with the mapped extent of a highly disturbed plant community. See Figures 3-11 and 3-12 below. A total area of 0.39ha was identified as Urban Exotic/Native

Figure 3-16. Plot 1 Start

Figure 3-17. Plot 1 End. Senescent *Kunzea ambigua* pictured.

Weeds and Exotics

Other areas of very high density weed infestations have been identified through mapping and ground survey. A total of 0.35ha was mapped as Weeds and Exotics that cannot be aligned to any PCT.

The batter of disturbed soil and debris created by the cutting of the central access road has created and area of highly disturbed weedy vegetation dominated by *Lantana camara, Senna pendula* and *Paspalum quadrifarium*. See Figures 3-16 and 3-17 below

Figure 3-18 Disturbed embankment south of access road verge.

Figure 3-19 Weed plume west of PCT 1783.

3.4 Threatened Ecological Communities (TECs)

(As outlined in Paragraphs 5.2.1.14–5.2.1.15)

Two (2) Endangered Ecological Communities (EECs) have been mapped within 1500m of the development site including Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region (Duffy's Forest) (PCT 1786) and Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin (Coastal Upland Damp Heath Swamp) (PCT 1803). Neither of these occur within the study area.

Duffy's Forest EEC is mapped as occurring 200m north of the study area. Consideration has previously been given to the possibility of this EEC occurring on site within the area identified as Red Bloodwood - Scribbly Gum / Old-man Banksia open woodland. However, previous survey effort (see Development Constraints Report TEC 2017) and the current survey did not identify this vegetation community on site.

3.5 Vegetation zones and integrity assessment

Three (3) vegetation zones were assessed for vegetation integrity. The zones were based on the Plant Community Types. The condition of each area of a particular plant community type did not appear sufficiently stratified to further separate these PCTs into separate zones based on condition. The two separate occurrences of PCT 1824 were joined in a common zone.

All plots consisted of intact woody native vegetation that are within 100m of each other and contiguous with the bushland of Manly Warringah War Memorial Park. An approximate patch size common to all zones of 300ha is calculated.

Table 3-6. Summary of vegetation zones and integrity assessment

NSW PCT No.	Veg Zone	Area (ha)	Patch size	Plots	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score
1250	1250_MOD	0.71	>100	5	79.6	20.9	59.5	**46.3**
1824	1824_MOD	0.44	>100	2, 4	80.7	85.7	44.1	**67.3**
1783	1783_MOD	1.34	>100	3				

Two separate areas of PCT 1824 were determined to be in similar enough condition to be combine as one vegetation zone. Although 2 plots were taken, the total zone area falls well short of the minimum size of a zone that requires 2 plots. Therefore data from plot 2 in the eastern patch closest to the development footprint was used to calculate the vegetation integrity score.

See **Appendix G** for plot field data sheets.

Map 4. Survey Effort

Map 5. Native PCTs (TEC 2018)

4 Threatened Species

4.1 Ecosystem credit species

Ecosystem credit species are threatened species which can be predicted to occur by vegetation surrogates and landscape features. Targeted survey is not required for these species.

Some species which have specialised breeding requirements have dual credit classes to account for differences in foraging and breeding habitat. For example, Glossy Black Cockatoo foraging habitat can be reliably predicted through vegetation associations, however breeding habitat requires hollow-bearing trees with hollows greater than 15cm diameter and greater than 5m above the ground (OEH Bionet)

The BAM calculator produced a list of ecosystem credit species based on a number of attributes including Bioregion and subregion, patch size and the vegetation and habitat data collected in the field.

Identify ecosystem credit species associated with PCTs on the development site as outlined in Section 6.2.

4.1.1 List of Ecosystem species derived

See Appendix B for a full list of ecosystem credit species derived on the development site. Species were excluded from the list generated by the BAM calculator that either did not meet geographic constraints, habitat constraints or showed a low likelihood of occurrence through the likelihood of occurrence assessment. The remaining species are shown in Table 4-1 below.

Table 4-1. Ecosystem Credit Species Derived

Scientific Name	Common Name	BC ACT	EPBC ACT
Calyptorhynchus lathami (foraging)	Glossy Black-Cockatoo	V	-
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	
Hoplocephalus bungaroides (foraging)	Broad-headed Snake	E	V
Kerivoula papuensis	Golden-tipped Bat	V	-
Lathamus discolour (foraging)	Swift Parrot	E	CE
Miniopterus australis (foraging)	Little Bentwing-bat	V	-
Miniopterus schreibersii oceanensis (foraging)	Eastern Bentwing-bat	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Neophema pulchella	Turquoise Parrot	V	-
Ninox connivens (foraging)	Barking Owl	V	-
Ninox strenua (foraging)	Powerful Owl	V	-
Petaurus australis	Yellow-bellied Glider	V	-
Phascolarctos cinereus (foraging)	Koala	V	V
Potorous tridactylus	Long-nosed Poteroo	V	V
Pteropus poliocephalus (foraging)	Grey-headed Flying-fox	V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Tyto novaehollandiae (foraging)	Masked Owl	V	-
Varanus rosenbergi	Rosenberg's Goanna	V	-
Anthochaera Phrygia (foraging)	Regent Honeyeater	CE	CE
Glossopsitta pusilla	Little Lorikeet	V	-
Petroica phoenicea	Flame Robin	V	-
Hieraaetus morphnoides (foraging)	Little Eagle	V	-
Petroica boodang	Scarlet Robin	V	-
Circus assimilis	Spotted Harrier	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-

4.1.2 Justification for exclusion of any ecosystem credit species predicted above

After reviewing the list of Threatened Species records from OEH BioNet Wildlife Atlas and EPBC Protected Matters Search, additional matters were considered in assessing which threatened species are likely to occur on the subject site. This included information such as the number of records within the 5 kilometre and 1 kilometre radius of the site, the dates of these records, the likelihood of detecting the species during a flora or fauna survey, the preferred species habitat requirements, and whether the study area contained suitable habitat for the species. See Table 4-2 below.

The determination of species for likelihood assessment requires the exclusion of those species that are not relevant to the site including species that either have not been recorded on the subject site during the field investigations and/or are unlikely to be present on the site due to the absence of suitable habitats (i.e. Extremely Low category).

Table 4-2. Threatened Species Likelihood of Occurrence Matrix

		Likelihood of Occurrence based on further investigations e.g. field survey, up-to-date local monitoring records					
		Species identified and suitable habitat occurs within the Subject Site	Species not identified but suitable habitat occurs within the Subject Site	Species not identified but partially disturbed or degraded habitat occurs within the Subject Site	Species not identified and no suitable habitat occurs within the Subject Site	Species not identified but suitable habitat occurs within 1 km of the Subject Site	Species not identified and suitable habitat occurs > 10 km away from the Subject Site
Likelihood of Occurrence based on desktop assessments (BioNet and EPBC PMS)		1	2	3	4	5	6
Expected to occur during the Project (i.e. high abundance of recent records within 5 km)	1	DOES OCCUR	HIGH	HIGH	MEDIUM	MEDIUM	LOW
Could occur during the Project (i.e. some recent records within 5 km)	2	DOES OCCUR	HIGH	MEDIUM	MEDIUM	LOW	LOW
Possible under exceptional circumstances (i.e. low numbers of recent records within 5 km)	3	DOES OCCUR	MEDIUM	MEDIUM	LOW	LOW	LOW
Unlikely to occur during the Project (i.e. old records but low in numbers)	4	DOES OCCUR	MEDIUM	LOW	LOW	LOW	EXTREMELY LOW
Very unlikely to occur during the Project (i.e. only old records)	5	DOES OCCUR	LOW	LOW	LOW	EXTREMELY LOW	EXTREMELY LOW
Extremely rare or previously unknown to occur (i.e. no records)	6	DOES OCCUR	LOW	LOW	EXTREMELY LOW	EXTREMELY LOW	EXTREMELY LOW

4.2 Species credit species

Species credit species are threatened species or elements of their habitat that cannot be confidently predicted by vegetation surrogates and landscape feature. Targeted survey is required for these species if the development site contains suitable habitat components and is within the predicted range of the species. Candidate species credit species that have been derived from the BAM calculator are presented in Table 4-3.

Assessment has been undertaken to determine if the habitat and geographic requirements are met within the development site and if targeted survey is required. The Table also provides the survey timing for each species (from the OEH Threatened Species Profile database.)

See Appendix C for a list of species credit species derived on the development site. After excluding species with very low likelihood of being present on the site, the remaining species for survey are shown below in Table 4-3.

Table 4-3. List of candidate fauna species credit species requiring survey on the subject site.

Scientific Name	Common Name	BC ACT	EPBC ACT	Survey Timing
Acacia terminalis subsp*. terminalis*	Sunshine Wattle	E	E	N/A
Callistemon linearifolius	Netted Bottle Brush	V	-	Sep - March
Cercartetus nanus	Eastern Pygmy-possum	V	-	Oct - March
Darwinia biflora	Darwinia biflora	V	V	Sep - Jan
Genoplesium baueri	Bauer's Midge Orchid	CE	E	Feb - March
Heleioporus australiacus	Giant Burrowing Frog	V	V	Sep - May
Hieraaetus morphnoides	Little Eagle	V	-	Aug - Oct
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)			All year
*Lophoictinia isura (*breeding*)*	Square-tailed Kite			Sept - Jan
Persoonia hirsuta	Persoonia hirsuta			Dec-May
Prostanthera junonis	Somersby Mintbush			Sep - Nov
Pseudophryne australis	Red-crowned Toadlet			All Year
Tetratheca glandulosa	Tetratheca glandulosa			July - Nov

V= Vulnerable, E = Endgered and CE= Critically Endangered

4.3 Targeted survey methods

A targeted survey was undertaken for the candidate species credit species. This was conducted under T.E.Cs scientific licence and animal research authority licence. Detailed descriptions of the survey methods used is provided in the following sections.

4.3.1 Flora survey

Targeted survey for the following threatened flora species was undertaken over the development site.

Threatened flora likely to occur within the locality were surveyed using the NSW Guide to Surveying Threatened Plants (OEH 2016b), as well as the most recent scientific research for that particular species. Targeted searches for threatened plant species according to the “random meander” method (Cropper 1993). When a potential threatened species was found and could not be identified using diagnostic details, a specimen was collected and sent to the Royal Botanic Gardens in accordance with

their protocols. The location of threatened flora species will be marked with a GPS and included in accompanying maps and data tables. Population size/extent and location mapping was also collected.

Native and exotic plant species were identified according to Field Guide to the Native Plants of Sydney (Robinson, 2003), Weeds of the south-east: an identification guide for Australia (Richardson et al. 2016) and PlantNET (Botanic Gardens Trust, 2018), with reference to recent taxonomic changes.

Any “weed infestations” found during the survey were recorded using a hand held GPS. Weed infestations are defined as:

- Areas where weeds make up > 80% percentage foliage cover.
- Weeds of national significance

If any Weeds of National Significance and/or any priority weeds for the Greater Sydney Region are listed in Table 5 4 which includes their biosecurity status under the Biosecurity Act 2015.

4.3.2 Fauna survey

The fauna survey was designed based on results from the desktop study, local knowledge of the area, and advice from Northern Beaches Council staff. All threatened species (and their habitat) known to occur within the locality were targeted during the fauna survey. Prior to planning the survey, each threatened species was researched to ensure the most up-to-date and effective survey method was used. The locations of threatened species, if recorded, were taken using a hand-held GPS unit and included in accompanying maps and data tables.

The survey methods were in accordance with the *Working Draft Threatened Biodiversity Survey and Assessment Guidelines* (DECC 2004). See

Table 4-4. Threatened Fauna survey methods (DECC 2004) for methods used for each fauna taxa group at the site.

In general the fauna survey included:

- identifying fauna habitats, assessing their condition and assessing their value to threatened fauna species;
- incidental observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings);
- Survey for avifauna (dawn chorus) and amphibians involving visual detection and aural recognition of bird and frog calls, as well as call playback for targeted threatened species;
- Spotlighting nocturnal searches
- Microbat call recordings and analysis.
- Nest boxes with motion sensing cameras
- Feral fauna surveyed using a variety of survey techniques including spotlighting, indirect evidence, and baited infrared motion-detecting cameras.
- As well as the requirement to record all hollow-bearing trees within BAM plots, hollow-bearing trees were searched for during other survey activities. Their location was recorded using a hand-held GPS and any notable characteristics recorded. Any that were deemed to be potential threatened fauna breeding habitat were mapped.
- Identification of Key Threatening Processes as listed under the BC Act 2016 and/or EPBC Act 1999 that are in operation that are affecting, or have potential to affect the fauna of the site.

In consideration of the survey requirements of the threatened candidate fauna species, the following methods were utilized:

Table 4-4. Threatened Fauna survey methods (DECC 2004)

Taxa group	Time of day	Survey Methods	Recommended duration (per stratification unit)	Time of year
Amphibian	Diurnal	Systematic day habitat search	1 hour	Varies according to the seasonal peak of activity of target species
Avifauna	Diurnal	Area search	<1ha (200m x 500m) 20-minute search is the most common method (Loyn 1986)	All year
	Nocturnal	Day habitat search	Search habitat for pellets, and likely hollows.	All year
		Infrared Motion-detecting Cameras	Deployed throughout the study area, baited with attractants.	
		Spotlighting	By foot or from a vehicle driven in first gear.	
Avifauna (migratory)	Diurnal	Area search	<1ha (200m x 500m) 20-minute search is the most common method (Loyn 1986)	During migratory season
Invertebrates	Diurnal	Habitat search	Targeting Dural woodland Snail habitat	All year
	Nocturnal	Spotlighting		
Mammals (excluding bats)	Diurnal	Active search	30 minutes active search for tree hollows, nests, scats, tracks and scratches	All year
		Collection of predator scats	Opportunistic collection of predator scats for hair analysis	
		Track search	1km of track search with emphasis on where substrate is soft	
	Nocturnal	Spotlighting on foot	2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	
	Trapping	Elliott traps	100 trap nights over 3-4 consecutive nights	
Mammals (Bats)	Diurnal	Day habitat search	Search for bat excreta at or near potential habitats	All year
	Nocturnal	Spotlighting and transect walking	For targeted survey near likely food resources: 2 x 1 hour spotlighting on two separate nights	
		Ultrasonic call recording	Two sound activated recording devices utilised for the entire night (a minimum of four hours), starting at dusk for two nights	October to March
Reptiles	Diurnal	Habitat search; logs, rocks, litter & base of trees	30-minute search on two separate days targeting specific habitat (November to March)	November to March

4.4 Targeted survey effort, details, and limitations

4.4.1 Targeted survey effort and timing

The survey was conducted by two (2) TEC Ecologists over forty-eight (48) person-hours from between March 2017 – May 2018, and remote surveying equipment monitored data from between November 2016 - and May 2018, see Table 4-5. Survey effort.

Table 4-5. Survey effort

Survey Date	Effort	Weather	Survey Methods
21/03/2017	2 hours	Partly Cloudy, 23° - 27°	***Floristic survey*** – 'Random meander' & target search for threatened species across study area.
24/03/2017	2 hours	Partly cloudy, light showers, 19° - 24°	***Floristic survey*** – 'Random meander' & target search for threatened species across study area.
12/11/2017	8 hours	Partly cloudy, 17° - 22°	***Floristic survey*** – 'Random meander' & target search for threatened species across study area. ***Fauna survey*** – Diurnal Habitat Assessment – Potential habitats for identified threatened species. Diurnal mammals – Active search for tree hollows, nests, scats, tracks and scratches. Micro-bats – Search for bat excreta at or near potential habitats Reptiles / Amphibians – Active search in habitats; logs, rocks, litter & base of trees.
4/04/2017 5/04/2017	2 hours	Overcast, light rain on 4th 22°	***Red Crown Toadlet Targeted Survey*** Amphibians - Frog aural detection (if any), and habitat suitability search.
4/04/2017 5/04/2017	2 hours	Overcast 22°	***Fauna survey*** – Nocturnal spotlighting and Call playback
22/11/16 – 24/11/16	3 nights	Clear – partly cloudy, 21° -13°	***Remote equipment*** – Anabat Express
17/01/2017 – 18/01/2017	2 nights	Clear 25° - 21°	***Remote equipment*** – Anabat Express
04/04/2017 – 11/04/2017	8 nights	Mainly partly cloudy with some light showers,15° -12°	***Remote equipment*** – Anabat Express
21/02/2018	16 hours	Overcast, Still, 19° -24°	***Floristic survey*** – BAM Plots
22/02/2018	8 hours	Overcast, light breeze 20°-26°	***Floristic survey*** – BAM Plots
28/03/2018	2 hours	Partly cloudy, 19° -24°	***Avifauna survey*** – Dawn chorus, incidental visual, aural recognition, evidence of presence.
29/03/2018 – 01/05/2018	34 days	Various ranging from max 35° to min 13°	***Remote equipment*** –Maginon Motion Detecting Camera and EPP nesting box
29/03/2018 – 05/05/2018	38 days	Various ranging from max 35° to min 13°	***Remote equipment*** –Maginon Motion Detecting Camera and EPP nesting box
01/05/18	6 hours	Fine 17°	***Fauna survey*** – Nocturnal spotlighting and Call playback

4.4.2 Targeted survey Methods

Spotlight Survey

Hand held LED torches and LED head torches were used to scan the trunks and canopy of trees and understory looking for any arboreal fauna with periodic scans of the ground layer. Frog calls were noted and attempts were made to capture frogs for positive identification.

Microbat Call Survey was performed with two Anabat Express units placed near the pond and open flyways along the access road. Recordings were analysed by an expert third party.

Call Playback

Call playback targeting Powerful Owl, Masked Owl, Barking Owl were made after spotlighting efforts. Call play back targeting Red-crown toadlet was also used during spotlighting when in proximity to moist areas.

4.4.3 Targeted survey limitations

The flora and fauna field survey was based on the recommendations of Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, Working Draft (DECC 2004).

As stated by the DECC (2004), 'The absence of a species from survey data does not necessarily mean it does not inhabit the survey area. It may simply mean that the species was not detected at that time with the survey method adopted and the prevailing seasonal or climatic conditions.' As such, the relative brevity of the survey and its timing mean that the full spectrum of fauna species and ecological processes likely to occur on the site cannot be fully quantified or described in this report. These limitations have been partly addressed by identifying potential habitats for fauna species and assessing the potential for these species to occur on the site based on previous records, the type and condition of habitats present, the land use throughout the subject site, surrounds and the landscape context.

When reviewing maps please note that the hand-held GPS equipment used is only accurate to 3 metres.

4.5 Targeted survey results

4.5.1 Flora results

A total of one hundred and eleven (111) plant species were recorded during the flora survey. This included eighty-nine (89) native species and twenty-two (22) introduced species, see **Table 14-1** for full flora species inventory, and **Table 5-1** for exotic species listed under the *Biosecurity Act 2015*.

The OEH Wildlife Atlas (OEH 2018a) identified eight (8) threatened plant species recorded within 5 km of the site. The EPBC Protected Matter Search Tool Report (DEE 2018) identified an additional twelve (12) threatened plant species previously recorded as occurring within a 5km radius of the site or which may have habitat nearby. Table 12-1 within Appendix C, summarises the site-specific habitat potential for the threatened flora species and populations previously recorded as occurring within a 5 km radius of the subject site.

No threatened flora species listed under the BC Act or EBPC Act were identified on the subject site in the current survey. No threatened flora species were assessed as having a moderate or high likelihood to occur on the site due to the absence of suitable habitat.

One (1) flora species, *Eucalyptus robusta* Swamp Mahogany recorded on the site is identified by Benson and Howell (1994) as regionally significant due to local populations being rare. The semi-mature specimens of the species appear to have been planted in a row on the subject site.. This species is also a component of Swamp Oak Swamp Forest Fringing Estuaries vegetation community.

Table 4-6. Species credit (flora) survey results

Common Name	Scientific Name	Targeted survey guidelines met?	Species detected?
Sunshine Wattle	*Acacia. terminalis subsp. terminalis*	Yes	No
Netted Bottle Brush	*Callistemon linearifolius*	Yes	No
Darwinia biflora	*Darwinia biflora*	Yes	No
Bauer's Midge Orchid	*Genoplesium baueri*	Yes	No
Persoonia hirsuta	*Persoonia hirsuta*	Yes	No
Somersby Mintbush	*Prostanthera junonis*	Yes	No
Seaforth Mintbush	*Prostanthera marifolia*	Yes	No
Tetratheca glandulosa	*Tetratheca glandulosa*	Yes	No

4.5.2 Fauna results

A total of twenty-five (25) vertebrate fauna species were recorded during the current field survey including five (5) threatened fauna species. All fauna species recorded during the current survey are listed in Appendix B **Table 15-1.**

The majority of confirmed fauna species recorded on the subject site are generally typical of urban areas, urban fringes and adjoining natural areas within the Sydney Basin Bioregion and are widespread in distribution and common to abundant within their ranges. Many of these species are Australian species who are highly successful in outcompeting less common natives.

4.5.2.1 Fauna habitat evaluation

The habitat values assessed on the site are summaries below in Table 4-7

Table 4-7. Fauna Habitat types and resources of the subject site

Habitat	Presence	Habitat Value for Threatened Species
Cleared areas	Lawns and gardens on eastern half of the site	Potential foraging sites for ecological generalists and predators such as Powerful Owls. Unlikely to support breeding habitat for threatened species.
	Access roads and pathways	Foraging and flyways for threatened or protected microchiropteran bat species.
Tree Canopy	Continuous and broken canopy of native and exotic trees	Foraging, nesting, roosting and sheltering for common protected small, medium and large birds, reptiles and common arboreal mammals. Large stags and emergent trees not present for raptor nesting sites in bushland areas.
Ground Cover	Understorey of native and exotic small trees and shrubs	Foraging, nesting, roosting and sheltering for common protected small and medium birds, reptiles and common arboreal mammals.
	Limited low dense shrub layer	Limited shelter and breeding sites for Brown bandicoots.
Leaf Litter	Present in much of remnant bushland	Shelter for red-crown toadlet and giant burrowing frogs.
Hollows	Very few present. Large hollows not observed on site	Nesting sites for arboreal mammals and birds.
Nectar sources	Good density of nectar bearing species in heath areas such as banksia and callistemon	Food source for birds and mammals including gliders, Regent Honey Eaters and Pygmy Possums.
Allocasuarinas	*Allocasuarina dystyla* common on site	Food source for Glossy Black Cockatoos
Aquatic habitat	Artificial Pond and drainage lines. Old excavation pit in Zone PCT_1783 provides an ephemeral pond after rain.	Potential habitat for threatened Red-Crowned Toadlets and Giant burrowing frog.

Habitat	Presence	Habitat Value for Threatened Species
Termite Mounds	Not found onsite.	Lack of breeding sites for Rosenberg's goanna.
Rocks and Crevices	Occasional crevices in sandstone.	Reptile shelter habitat but not suitable habitat for threatened species. No larger overhangs or caves for microbat roosting

Figure 20 – Pond near southern boundary

Figure 21 – Old excavation pit containing water after rain.

Figure 22 – Sandstone bench and crevices.

Anabat Data

Date:	23/9/16	24/9/16	22/11/16	23/11/16	24/11/16	17/1/17	18/1/17	4/4/17	5/4/17	6/4/17	7/4/17	8/4/17	9/4/17	10/4/17	11/4/17
Total sequence files:	0	100	151	21	40	707	57	117	293	91	61	42	83	79	87
Number of identifiable calls:	0	8	13	7	18	681	45	40	229	86	50	23	54	68	82
Positively identified species															
Chalinolobus gouldii			7		5	499	6		1	3	2				13
Chalinolobus morio		1				1	3								
Vespadelus darlingtoni		1													
Vespadelus vulturnus							13								
Miniopterus australis									5	3	3	4		2	
Miniopterus orianae oceanensis				1	2		1	37	223	79	44	15	54	64	67
Austronomus australis			1	1	3									2	
Calls not positively identified															
Myotis macropus / Nyctophilus sp.						27	11								
Scotorepens orion / Scoteanax rueppellii						25	4								
V. vulturnus / C. morio		1					4					1			
V. darlingtoni / M. o. oceanensis					1	1		3				2			
Mormopterus ridei / M. norfolkensis		3		1		14									
Mormopterus sp. / C. gouldii		2	5	4	7	114	3			1	1	1			2

4.5.2.2 Species credit fauna results

Table 4-8. Species credit (fauna) survey results

Common Name	Scientific Name	Targeted survey guidelines met?	Species detected?
Eastern Pygmy-possum	Cercartetus nanus	Yes	Yes
Giant Burrowing Frog	Heleioporus australiacus	Yes	No
Little Eagle	Hieraaetus morphnoides	Yes	No
Southern Brown Bandicoot (eastern)	Isoodon obesulus obesulus	Yes	No
Square-tailed Kite	Lophoictinia isura (breeding)	Yes	No
Red-crowned Toadlet	Pseudophryne australis	Yes	No

4.5.3 Species credit species detected

Figure 23 – Image of Eastern Pygmy Possum entering a tree hollow.

A likely sighting of an Eastern Pygmy Possum was made by a motion camera set-up approximately 30m west of the subject site in neighbouring Sydney Water Easement.

4.5.3.1 Habitat components and credit requirements

Table 4-9. Habitat components for species credit species recorded

Common Name	Scientific Name	Credit Class	Biodiversity Risk Weighting	Habitat components (breeding)	Present on site?	Credits required?
Eastern Pygmy Possum	**Cercartetus nanus**	Species	2	No	Yes	No

Likely nesting sites were not noted on the subject site however both vegetation communities subject to clearing were considered foraging habitat for this species. The species polygon can therefore be assumed to overlap with all native vegetation to be cleared and has not been mapped.

Stage 2: Impact Assessment (Biodiversity Values)

5 Avoid and Minimise Impacts

5.1 Impact avoidance

Avoidance

The development proposal avoids most impacts to biodiversity on the subject site through its position in zones of mostly cleared areas on the eastern side of the site. Some of the planted native trees in this area can be retained in the proposal. Vegetation clearing will primarily occur in the plant community identified as disturbed native/exotic or weedy growth not aligned with any native plant communities.

The previously cut drainage line running from north to south has created boundary between the areas of disturbed lawn and the bushland zones, which remain in good conditions. This may be because the drainage line contained the areas accessible to mowing and prevented the infiltration of surface run-off from the managed lawns. The developments footprint is largely bounded by the drainage channel.

An intermittent 5 metre wide strip of native vegetation will be removed in order to gain access to install pools and riffles in the main channel above the access road. This vegetation will be modified to remove the shrub layer and create a native grassland with a native tree canopy in order to contribute the APZ.

5.2 Measures to minimise impacts

5.2.1 Drainage Impacts

The drainage line's current format of a straight cut channel in sandstone provides relatively little habitat value for aquatic and semi-aquatic fauna as it supports no pools or aquatic vegetation. The design proposal to embellish the drainage line with a "naturalistic character" would greatly improve the habitat value of this drainage line. The design shows the creation of pools, and the placement of boulders in the channel which can break the speed of water flow and created many habitat features for aquatic flora and fauna. It is recommended that company with ecological creek line restoration experience be consulted to provide both an aesthetic and functional design for these creek works.

5.2.2 Soil Erosion and Sediment Control

Soil erosion and sediment control must be mitigated throughout the construction process using approved mitigation measures such as sediment fencing, or the use of hay bales, to reduce sediment laden run-off from entering the drainage lines, or running down-slope off the site. If mitigation methods are followed, soil erosion and sedimentation are unlikely to be an ongoing impact.

Bio filtration swales planned near the existing pond in the south western corner of the development site should minimise additional nutrient and run-off from lawns and gardens during the operational stage of the proposal.

Mitigation measures have been proposed which will maintain and enhance riparian landscapes, stabilise erosion and downstream sedimentation, reduce stormwater runoff, and preserve the natural components that contribute to ecological value of the site. These include Water Sensitive Urban Design (WSUD) measures such as vegetated swales, On-site Stormwater Detention (OSD) systems such as detention and retention basins, and site rehabilitation through bush regeneration and riparian revegetation, amongst others.

This Waterway Impact Statement provides a waterways analysis, assessment of impacts, assessment of compliance with the Warringah DCP 2011, and provision of mitigation measures in regards to the proposal and surrounding environment.

The proposed development will, on balance, have positive impacts on the waterway and will result in better onsite detention, reduced flow rates, better aquatic habitat, healthier bushland and a reduced weed seed source to the catchment below

Weed Control

After clearing is completed, remaining weeds between the clearing boundary and remnant native bushland are to be removed by bush regeneration contractors. Any collection and disposal of weed

material is to be undertaken using techniques and methods that do not result in the spread of propagules. Ongoing weed control across the whole subject site through the use of a Vegetation Management Plan is addressed in mitigating and managing impacts on Biodiversity

Disturbance of soils on the site should be limited to the areas of proposed work. Activities such as stock piling of soils or substrates should not extend into adjacent native vegetation.

Plant, machinery or vehicles utilised during clearing and construction must follow appropriate cleaning protocols to be free of introducing new weeds and potential pathogens.

Ongoing and regular weed control in the remnant bushland is recommended for maintaining and improving ecological, bushfire control and aesthetic outcomes.

Of the twenty-two (22) introduced species identified onsite, nineteen (19) are listed as biosecurity risk as part of the *Greater Sydney Regional Strategic Weed Management Plan 2017-2022* under the *Biosecurity Act 2015* (NSW).

All weed species which require management under the *Biosecurity Act 2015* (NSW) are listed in **Table 5-1.** Weed species found on site which require management under the *Biosecurity Act 2015* (NSW**)**, along with category of management, practical weeding techniques, herbicide application, group, and recommended application ratios.

5.2.3 Mitigating and managing impacts on biodiversity values

A Vegetation Management Plan (VMP) prepared by Total Earth Care (TEC 2017) is to be implemented. The VMP should increase the vegetation integrity of all native PCT zones within the subject site by addressing exotic weeds using standard bush regeneration techniques. Areas currently mapped as zones dominated by exotic weeds are addressed in the VMP to be cleared and managed in such a way as to prevent further encroachment.

Table 5-1. Weed species found on site which require management under the *Biosecurity Act 2015* (NSW)

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds-Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Other Exotic Species to Pose Risk	Weeding Technique	Herbicide Application	Herbicide Group	Recommended Application Ratios
Crofton Weed	*Ageratina adenophora*				Environment, Agriculture	Asset Protection	Hand removal, brush cut and foliar sprayed with Glyphosate	Glyphosate 360g/L	M	1/100
Whisky Grass	*Andropogon virginicus*				Environment		Remove seed and crown out with knife or spot spray	Glyphosate 360g/L	M	1/101
Asparagus Fern	*Asparagus aethiopicus*	Yes				Asset Protection	Small single specimens to be crowned or Sprayed with Glyphosate/metsulfuron methyl	Glyphosate 360g/L & Metsulfuron-Methyl 600 g/kg	M & B	1/100 & 1g/10L
Spear Thistle	*Cirsium vulgare*					Asset Protection	Foliar spraying with Glyphosate, hand pulled and brush cut	Glyphosate 360g/L	M	1/100
Umbrella Sedge	*Cyperus eragrostis*					Asset Protection	De-seeded and hand pulled			
Panic Veldgrass	*Ehrharta erecta*					Asset Protection	Foliar spraying with Glyphosate	Glyphosate 360g/L	M	1/100
Crucifix Orchid	*Epidendrum radicans*					Asset Protection	Hand removal.			
African Lovegrass	*Eragrostis curvula*				Environment	Asset Protection	Hand pulled or brush cut and foliar sprayed with Glyphosate	Glyphosate 360g/L	M	1/100
Lantana	*Lantana camara*	Yes	Asset Protection			Asset Protection	Cut and paint, sprayed or splattered with Glyphosate	Glyphosate 360g/L	M	Neat

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds-Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Other Exotic Species to Pose Risk	Weeding Technique	Herbicide Application	Herbicide Group	Recommended Application Ratios
Small Leaf Privet	*Ligustrum sinense*					Asset Protection	<80mm cut & painted; >80mm will be drilled/frilled with neat Glyphosate	Glyphosate 360g/L	M	Neat
Japanese Honeysuckle	*Lonicera japonica*				Environment		Scrape & painted with Glyphosate	Glyphosate 360g/L	M	Neat
Ochna	*Ochna serrulata*				Environment		Double side scrape and paint all stems to 75% coverage.	Glyphosate 360g/L	M	Neat
Caterpillar Grass	*Paspalum dilatatum*					Asset Protection	Foliar spraying with Glyphosate	Glyphosate 360g/L	M	1/100
Tussock Paspalum, Blue Grass	*Paspalum quadrifarium*				Environment		Hand pulled or brush cut and foliar sprayed with Glyphosate	Glyphosate 360g/L	M	1/50
Blackberry	*Rubus fruticosus* aggregate	Yes					Brush cut, crowned and scraped & painted with neat Glyphosate	Glyphosate 360g/L	M	Neat
Senna / Cassia	*Senna pendula*				Environment		Small individuals hand removed, larger plants cut and painted with neat Glyphosate	Glyphosate 360g/L	M	Neat
Pigeon Grass	*Setaria parviflora*					Asset Protection	Foliar spraying with Glyphosate, hand pulled and brush cut	Glyphosate 360g/L	M	1/100
Tobacco Bush/ Wild Tobacco	*Solanum mauritianum*				Environment, Agriculture		Cut & paint with Glyphosate	Glyphosate 360g/L	M	Neat

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds-Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Other Exotic Species to Pose Risk	Weeding Technique	Herbicide Application	Herbicide Group	Recommended Application Ratios
Watsonia	*Watsonia meriana*				Environment		Hand removal of plant and corms if soil conditions suit. Foliar spraying with diluted Glyphosate. Painting with neat Glyphosate.	Glyphosate 360g/L	M	1/100 & Neat

The land occupier's obligations under this Act are summarised in Table 5-2. Categories of Management under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022 under the NSW Biosecurity Act 2015 below.

Table 5-2. Categories of Management under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022 under the NSW Biosecurity Act 2015

Category	Management Action
Prevention (Prevent)	To prevent the weed species arriving and establishing in the Region.
Eradication (Eliminate)	To permanently remove the species and its propagules from the Region, OR to destroy infestations to reduce the extent of the weed in the region with the aim of local eradication.
Containment (Minimise)	To prevent the ongoing spread of the species in all or part of the Region.
Asset Protection (Manage)	To prevent the spread of weeds to key sites/ assets of high economic, environmental and social value, or to reduce their impact on these sites if spread.

5.2.4 Pre-clearance survey and tree removal supervision

The majority of the vegetation clearance occurs in non-native plant communities, however the shrub layers within these areas were observed to contain possum dreys. Pre-clearance survey is recommended for vegetation clearing.

5.2.5 External lighting

Lighting along the western boundary of the proposed development has the potential to have a negative impact on fauna. It is recommended that external lighting is not directed into adjoining bush.

5.2.6 Summary of minimisation and mitigation actions

Measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility

Table 5-3. Summary of minimisation and mitigation measures

Management Action	Timing	Responsibility
Clearing management	Prior to clearing	Clearing contractor/surveyor
Pre-clearing survey	Prior to clearing	Ecologist
Weed control	After clearing and earthworks	Bush regenerator
Erosion and sedimentation control	Prior/during/after clearing and earthworks	Building contractor

5.3 Impacts unable to be avoided

5.3.1 Direct impacts

The primary direct impact of the proposal is the removal of vegetation and habitat including disturbed and intact native vegetation. The loss of native vegetation can be offset through biodiversity credits. No hollow bearing trees will be removed.

5.3.2 Indirect impacts

5.3.2.1 During construction

Injury/mortality during clearing: This is a small risk given the lack of hollows. The clearing is to occur adjacent to retained bush land providing escape pathways for fauna that may be impacted. Dense weed growth can provide nesting habitat for some birds and possums.

Erosion and sedimentation: Standard controls by the construction contractor should ensure the prevention of erosion and sedimentation during construction and post construction.

5.3.2.2 During operation

Edge effects: Additional edge boundaries to intact bushland are not being created by the proposal. The vegetation management plan aims to eliminate boundaries subject to weed ingress along the access road edge and other weed plumes.

Introduction of feral and domestic predators: Depending on the Villages policy on domestic animal, the proposal could increase the proximity of domestic animal to the remaining bushland.

Increased human presence: The proposal is situated on land that is already subject to some human presence in the form of mowing and outdoor recreation. There would be some increase in human activity, vehicles and noises close to the remnant bushland.

5.4 Serious and irreversible impacts

In accordance with Subsections 10.2.2 for impacts on CEECs and 10.2.3 for threatened species no Serious and Irreversible impacts require assessment.

6 Impact Summary

The area of native vegetation clearing required is small and triggers the minimum credit requirements for the two native plant communities impacted. Although fauna credit species have been identified the areas subject to clearing are not sufficiently large enough to trigger any credit requirements by the BAM calculator.

Table 6-1. Ecosystem credits required

Zone	PCT Name	Current integrity score	Future integrity score	Change in integrity score	Biodiversity Risk Weighting	Credit requirement
1824_Good	1824 – Mallee Banksia, Tea-tree …	46.3	40.4	-5.9	1.5	1
1250_Good	1250 – Sydney Peppermint...	67.3	66.4	-0.9	1.5	1

7 Biodiversity Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011375/BAAS18094/18/00011534	Allambie Heights Village	24/02/2018
Assessor Name	**Report Created**	**BAM Data version ***
Kelly Askew	12/07/2018	3
Assessor Number	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet	
BAAS18094		

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone	Vegetation	Area (ha)	Constant	Species sensitivity to gain class (for	Biodiversity risk	Candidate SAII	Ecosystem
Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin								
1	1824_Good	5.9	0.4	0.25	High Sensitivity to Potential Gain	1.50		1
							Subtotal	**1**
Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin								
2	1250_Good	0.9	0.7	0.25	High Sensitivity to Potential Gain	1.50		1
							Subtotal	**1**
							Total	**2**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
1824_Good	5.9	0.02	0.25	2	False	0
1250_Good	0.9	0.01	0.25	2	False	0
					Subtotal	**0**

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9 Glossary

BC Act – the New South Wales Biodiversity Conservation Act 2016

C (CAMBA) under the EPBC Act - China-Australia Migratory Bird Agreement: Refers to species listed in the Bilateral Agreement between the Government of Australia and the Government of the People's Republic of China for the protection of Migratory Birds and their Environment (Subdivision A of Division 1 of Part 5, Commonwealth EPBC Act 1999).

CE (Critically Endangered) under the EPBC Act - Refers to a native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (Subdivision A of Division 1 of Part 13, Commonwealth EPBC Act 1999).

E (Endangered) under the EPBC Act - Refers to a native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (Subdivision A of Division 2 of Part 13, Commonwealth EPBC Act 1999).

E1 (Endangered) under the BC Act - Refers to fauna and flora species that are likely to become extinct in nature in NSW unless the circumstances and factors threatening its survival or evolutionary developments cease to operate; or, its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction; or, it might already be extinct, but it is not presumed extinct.

E4 (Extinct) under the BC Act - Refers to fauna and flora species that have not been located in nature during the preceding 50 years despite searching of known and likely habitats of that period

E4A (Critically Endangered) under the BC Act - Refers to a species that is eligible to be listed as a critically endangered species if, in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with criteria prescribed by the regulations.

EPBC Act 1999 - Environment Protection and Biodiversity Conservation Act 1999.

J (JAMBA) under the EPBC Act - Japan-Australia Migratory Bird Agreement: Refers to species listed in the Bilateral Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (Subdivision A of Division 1 of Part 5, Commonwealth EPBC Act 1999).

K (ROKAMBA) under the EPBC Act - Republic of Korea-Australia Migratory Bird Agreement: Refers to species listed in the Bilateral Agreement between the Government of Australia and the Government of the Republic of Korea for the protection of Migratory Birds and their Environment (Subdivision A of Division 1 of Part 5, Commonwealth EPBC Act 1999).

KTP - Key Threatening Process

OEH – Office of Environment and Heritage

PCTs – Plant Community Types

PEMP – Property Environment Management Plan

SOFF - Swamp Oak Floodplain Forest

TEC – Total Earth Care Pty Ltd

Threatened – means 'Vulnerable' or 'Threatened' under the Biodiversity Conservation Act 2016

V (Vulnerable) under the BC Act - Refers to fauna and flora species that are likely to become endangered unless the circumstances & factors threatening its survival or evolutionary development cease to operate

WONS – Weeds of National Significance

10 Appendix A: List of ecosystem credit species derived on the development site

Table 10-1. Ecosystem credit species

Common Name	Scientific Name	BC ACT	EPBC ACT	Include	Survey Timing
*Calyptorhynchus lathami (*foraging*)*	Glossy Black-Cockatoo	V	-	Yes – Presence of Casuarina species	
Ixobrychus flavicollis	Black Bittern	V	-	No – Land not within 40m of water.	
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Yes	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Yes	N/A
*Hoplocephalus bungaroides (*foraging*)*	Broad-headed Snake	E	V	No – No records in the LGA	Aug - Sep (breeding)
Kerivoula papuensis	Golden-tipped Bat	V	-	Yes	N/A
*Lathamus discolour (*foraging*)*	Swift Parrot	E	CE	Yes	May - Aug
Lophoictinia isura	Square-tailed Kite	V	-	Yes – Sighting close to site in 2013	Sept - Jan
*Miniopterus australis (*foraging*)*	Little Bentwing-bat	V	-	Yes	Dec – Jan (breeding)
*Miniopterus schreibersii oceanensis (*foraging*)*	Eastern Bentwing-bat	V	-	Yes	Nov- Feb (breeding)
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Yes	
Neophema pulchella	Turquoise Parrot	V	-	Yes	

Common Name	Scientific Name	BC ACT	EPBC ACT	Include	Survey Timing
*Ninox connivens (*foraging*)*	Barking Owl	V	-	Yes	
*Ninox strenua (*foraging*)*	Powerful Owl	V	-	Yes	
*Pandion cristatus (*foraging*)*	Eastern Osprey	V	-	No – No living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting	
Petaurus australis	Yellow-bellied Glider	V	-	No – No Bionet records for LGA	
*Phascolarctos cinereus (*foraging*)*	Koala	V	V	No – Out of range of existing populations	
Potorous tridactylus	Long-nosed Poteroo	V	V	No – No recent sightings in LGA	
*Pteropus poliocephalus (*foraging*)*	Grey-headed Flying-fox	V	V	Yes	Oct – Dec (breeding)
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Yes	N/A
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Yes	N/A
*Tyto novaehollandiae (*foraging*)*	Masked Owl	V	-	Yes	May – Aug (breeding)
Varanus rosenbergi	Rosenberg's Goanna	V	-	Yes	N/A

Common Name	Scientific Name	BC ACT	EPBC ACT	Include	Survey Timing
*Anthochaera Phrygia (*foraging*)*	Regent Honeyeater	CE	CE	Yes	
*Callocephalon fimbriatum (*foraging*)*	Gang-gang Cockatoo	V	-	No - Geographic requirement not met	
Glossopsitta pusilla	Little Lorikeet	V	-	Yes	N/A
Petroica phoenicea	Flame Robin	V	-	Yes	N/A
*Hieraaetus morphnoides (*foraging*)*	Little Eagle	V	-	Yes	Aug – Oct (breeding)
Petroica boodang	Scarlet Robin	V	-	Yes	N/A
Circus assimilis	Spotted Harrier	V	-	No – No recent sightings in LGA since 2000	N/A
Daphoenositta chrysoptera	Varied Sittella	V	-	Yes	N/A
*Haliaeetus leucogaster (*foraging*)*	White-bellied Sea-Eagle	V	-	No – Site is > 1km from water body.	N/A

11 Appendix B: List of candidate species credit species derived on the development site

Table 11-1. Species credit species

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
Acacia bynoeana	Bynoe's Wattle	E	V		Areas	No – no records in the LGA for 30 years	Sep - Jan
Acacia prominens - endangered population	Gosford Wattle, Hurstvile and Kogarah LGA	EP	-		No - Hurstville and Kogarah Local Government	No	
Acacia terminalis subsp. *terminalis*	Sunshine Wattle	E	E			No – no near	
Allocasuarina portuensis	Nielsen Park She-oak	E	E			No – not recorded in the LGA	Jan -Aug
*Anthochaera Phrygia (*breeding*)*	Regent Honeyeater	CE	CE			No – Outside of known breeding areas.	
Asterolasia elegans	Asterolasia elegans	E	E			Yes – but unlikely	All Year
Astrotricha crassifolia	Thick-leaf Star-hair	V	V			No – no recorded in the LGA in 30 years	All Year
Caladenia tessellata	Thick Lip Spider Orchid	E	V			No – no record in the LGA in 30 years	Sept, Oct
Callistemon linearifolius	Netted Bottle Brush	V	-			Yes	Sep - March
*Callocephalon fimbriatum (*breeding*)*	Gang-gang Cockatoo	V	-			No – Out of range of population	

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
Callocephalon fimbriatum - endangered population	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGA	EP	-		No	No – Out of range of population	
*Calyptorhynchus lathami (*breeding*)*	Glossy Black-Cockatoo	V	-			No – Lack of large hollow bearing trees.	March - Aug
Camarophyllopsis kearneyi	Camarophyllopsis kearneyi	E	-		No	No – Outside known range of Lane Cove NP	
Cercartetus nanus	Eastern Pygmy-possum	V	-		Yes	Yes	
Chalinolobus dwyeri	Large-eared Pied Bat	V	V			No – not within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V			No – not recorded in the LGA for 30 years	Nov - Feb
Darwinia biflora	Darwinia biflora	V	V			Yes – sightings nearby	Sep - Jan
Darwinia glaucophylla	Darwinia glaucophylla	V	-			No - No records in LGA for 30 years	
Darwinia peduncularis	Darwinia peduncularis	V	-			No - No records in LGA for 30 years	

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
Diuris bracteata	Diuris bracteata	E	Extinct			No – Only know remnant population near Gosford.	
Eucalyptus camfieldii	Camfield's Stringybark	V	V			No – Unlikely, not close to know trees.	
Genoplesium baueri	Bauer's Midge Orchid	CE	E		Yes	Yes – but unlikely	Feb - March
Genoplesium plumosum	Tallong Midge Orchid	CE	E		No - Around Kurnell	No	
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-			No – not found in LGA and lack of moist forest habitat.	
Grevillea shiressii	Grevillea shiressii	V	V		No - within Brisbane Water National Park	No	
*Haliaeetus leucogaster (*breeding*)*	White-bellied Sea-Eagle	V	-			No – Lack of emergent eucalypts or stags for breeding sites.	
Haloragodendron lucasii	Haloragodendron lucasii	E	E			No known populations in the LGA	All Year
Heleioporus australiacus	Giant Burrowing Frog	V	V			Yes – Pond present	Sep - May
Hibbertia procumbens	Spreading Guinea Flower	E	-		No- North of Hawkesbury River	No	

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
Hibbertia puberula	Hibbertia puberula	E	-			No – recent sightings in the LGA	Sep - Feb
Hibbertia spanantha	Julian's Hibbertia	CE	CE	No – requires light clay on shale sandstone transition		No - Not suitable habitat.	
Hieraaetus morphnoides	Little Eagle	V	-			Yes -	Aug – Oct
Hoplocephalus bungaroides	Broad-headed Snake	E	V		No	No – No recent records in the LGA	
Hygrocybe anomala var. *ianthinomarginata*	Hygrocybe anomala var. ianthinomarginata				No - Lane Cove Bushland Park	No	
Hygrocybe aurantipes	Hygrocybe aurantipes				No - Lane Cove Bushland Park	No	
Hygrocybe austropratensis	Hygrocybe austropratensis				No - Lane Cove Bushland Park	No	
Hygrocybe collucera	Hygrocybe collucera				No - Lane Cove Bushland Park	No	

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
Hygrocybe griseoramosa	Hygrocybe griseoramosa				No - Lane Cove Bushland Park	No	
Hygrocybe lanecovensis	Hygrocybe lanecovensis				No - Lane Cove Bushland Park	No	
Hygrocybe reesiae	Hygrocybe reesiae				No - Lane Cove Bushland Park	No	
Hygrocybe rubronivea	Hygrocybe rubronivea				No - Lane Cove Bushland Park	No	
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)			Yes	Yes	Yes	All year
Kunzea rupestris	Kunzea rupestris			No – Sandstone outcrops	No	No – Only recent sighting at Ingleside and habitat constraints not met.	
Lasiopetalum joyceae	Lasiopetalum joyceae			No – lateritic to shaley ridgetops		No	
Lathamus discolour (breeding)	Swift Parrot			No	No - outside of known breeding areas	No	Sep to April out of breeding

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
Leptospermum deanei	Leptospermum deanei			No		No	All Year
Litoria aurea	Green and Golden Bell Frog			Yes – within 1km of wet areas.		No – Only known population in the LGA was introduced to Longreef golf club	
*Lophoictinia isura (*breeding*)*	Square-tailed Kite			Not preferred breeding habitat		Yes	Sept - Jan
Melaleuca deanei	Deane's Paperbark			No		No	Dec - Feb
Melaleuca groveana	Grove's Paperbark			No		No	All Year
Micromyrtus blakelyi	Micromyrtus blakelyi					No – Not known in the LGA	
*Miniopterus australis (*breeding*)*	Little Bentwing-bat			No		No – caves on site	
*Miniopterus schreibersii oceanensis (*breeding*)*	Eastern Bentwing-bat			No		No	
*Myotis macropus (*breeding*)*	Southern Myotis			No		No	Nov - Mar
*Ninox connivens (*breeding*)*	Barking Owl			No – requires large hollows >4m above ground.		No	May – Dec Breeding

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
*Ninox strenua (*breeding*)*	Powerful Owl			No – Requires >200mm hollows		No –	May – Aug Breeding
*Pandion cristatus (*breeding*)*	Eastern Osprey			No – Not sufficient proximity to floodplain		No	
Perameles nasuta - endangered population	Long-nosed Bandicoot, North Head			Site out of range	No	No	
Persoonia hirsuta	Persoonia hirsuta					Yes	Dec-May
Persoonia mollis subsp*. maxima*	Persoonia mollis subsp. maxima					No	
Petaurus norfolcensis	Squirrel Glider			No historic sightings within 5km of the site		No	
Petaurus norfolcensis - endangered population	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill				No – Out of population range	No	
Phascolarctos cinereus	Koala				No – no recent local sightings	No	
Phascolarctos cinereus - endangered population	Koala in the Pittwater Local Government Area				No – out of range	No	

Common Name	Scientific Name	BC ACT	EPBC ACT	Habitat on site	Geographic Requirement met	Candiate Species for Survey	Survey Timing
Pommerhelix duralensis	Dural Woodland Snail				No – out of known range	No	
Prostanthera junonis	Somersby Mintbush					Yes	Sep - Nov
Pseudophryne australis	Red-crowned Toadlet					Yes	All Year
*Pteropus poliocephalus (*Breeding*)*	Grey-headed Flying-fox			No		No	
Tetratheca glandulosa	Tetratheca glandulosa					Yes	July - Nov
*Tyto novaehollandiae (*Breeding*)*	Masked Owl			No – trees with hollows >20cm		No	
Wahlenbergia multicaulis - endangered population	Tadgell's Bluebell in the local government areas of Auburn, Bankstown				No - Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	No	

12 Appendix C. Threatened flora and fauna likelihood of occurrence assessment tables

Table 12-1. Likelihood of occurrence of threatened flora species on the site identified through bionet 5km search.

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
Bynoe's Wattle	*Acacia bynoeana*	Occurs in heath or dry sclerophyll forest on sandy soils. Known suitable habitat includes open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds, and in recently burnt patches.	**Low**. Not found onsite. May occur post fire.	E1	V
Downy Wattle	*Acacia pubescens*	Found in association with alluviums, shales, and at the intergrade between shales and sandstones, in open woodland and forest. Flowers from August to October. Pollination is usually by insects and birds. Recruitment is more commonly from vegetative reproduction than from seedlings. Minimum fire free period of 5 - 7 years to allow an adequate seedbank to develop. Known from the Bankstown-Fairfield-Rookwood area and Pitt Town area, with outliers occurring at Barden Ridge, Oakdale, and Mountain Lagoon.	**Low**. Not found onsite. Possible shale lenses on site. Closest records >2km away. Unlikely to have spread as usually reproduced vegetatively.	V	V
Sunshine Wattle	*Acacia teminalis* subsp. *terminalis*	Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. Recent collections have mainly been made from the Quarantine Station, Clifton Gardens, Dover Heights, Parsely Bay, Nielson Park, Cooper Park, Chifley and Watsons Bays. Occurs in coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Most areas of habitat or potential habitat are small and isolated. Most sites are highly modified or disturbed due to surrounding urban development.	**Low**. Not found onsite. Found closer to harbor foreshores. May occur post fire.	S1	E
-	*Ancistrachne maidenii*	Restricted to northern Sydney, around St Albans - Mt White - Maroota - Berowra areas and to the Shannon Creek area south-west of Grafton. Specific habitat requirements, with populations occurring in distinct bands in areas associated with a transitional geology. Grows in dry sclerophyll forest on sandstone-derived soils and flowers in summer.	**Low.** Not detected during the current survey. Not searched in suitable flowering season. Low quality suitable habitat onsite.	V	-
-	*Asterolasia elegans*	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Likely to occur in the western part of Gosford local government area. Found on hawkesbury sandstone in sheltered forests on mid to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Forest Oak (*Allocasuarina torulosa*) and Christmas Bush (*Ceratopetalum gummiferum*). Considered to be fire sensitive and reliant on seed germination after disturbance to maintain populations. Can remain present in soil seed bank for a number of years. The longevity of each crop of seed in the soil is probably relatively short (perhaps 5 - 10 years). Either	**Medium.** Not detected during the current survey. Some suitable habitat onsite. No records within 5km.	E1	E

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		heat or smoke or a combination of these factors may play a role in breaking soil-stored seed dormancy.			
Thick Lip Spider Orchid	*Caladenia tessellata*	Populations at Wyong, Ulladulla and Braidwood in NSW. There are no recent records of the species occurring in the Sydney region. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	**Low.** Not detected during the current survey. Unlikely to occur due to geographic restriction.	E1	V
Netted Bottle Brush	*Callistemon linearifolius*	Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring – summer. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. The species was more widespread in the past, and there are currently only 5-6 populations remaining from the 22 populations historically recorded in the Sydney area. Three of the remaining populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park.	**Low**. Not found onsite. Very obvious species. May occur post fire.	V	-
Sand Spurge	*Chamaesyce psammogeton*	Found sparsely along the coast from south of Jervis Bay (at Currarong, Culburra and Seven Mile Beach National Park) to Queensland (and Lord Howe Island). Populations have been recorded in Wamberal Lagoon Nature Reserve, Myall Lakes National Park, Moonee Beach Nature Reserve and Bundjalung National Park. Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (*Spinifex sericeus*) and Prickly Couch (*Zoysia macrantha*).Seeds float, so some dispersal between beaches may occur.	**Low**. Not detected during the current survey. No available habitat on site. No records within 5km.	E	-
Leafless Tongue-orchid	*Cryptostylis hunteriana*	Occurs mainly in coastal districts, from the Gibralter Range National Park in the north to Orbost in Victoria in the south. Recently observed at many sites between Batemans Bay and Nowra, although uncommon at all sites. Known from a range of communities, including swamp-heath and woodland. Often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). Little is known about the ecology or habitat preferences. Larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community.	**Low.** Not detected during the current survey. Associated canopy species occur on site, however, the site is dominated by closed understorey. Unlikely to occur due to geographic restriction.	V	V
-	*Darwinia biflora*	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *E. haemastoma*, *C. gummifera* and/or *E. squamosa*. The vegetation structure is usually woodland, open	**Low**. Not detected during the current survey. Obvious species.	V	V

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		forest or scrub-heath. Flowering occurs throughout the year but is concentrated in autumn, with mature fruits being produced from May to August. Fire is an important factor in the life cycle of this species.	Associated overstorey species occur on site, however, the site is dominated by closed understorey. Unlikely to occur due to geographic restriction.		
-	*Darwinia peduncularis*	Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone. Flowers in winter to early spring. Pollinators are honeyeater birds. Occurs as local disjunct populations in coastal NSW with a couple of isolated populations in the Blue Mountains. It has been recorded from Brooklyn, Berowra, Galston Gorge, Hornsby, Bargo River, Glen Davis, Mount Boonbourwa and Kings Tableland.	**Low.** Not detected during the current survey. Obvious species. Associated canopy species occur on site, however, the site is dominated by closed understorey. Unlikely to occur due to geographic restriction.	V	-
-	*Diuris bracteata*	For over 100 years *Diuris bracteata* was known only from the original collection made near Gladesville in northern Sydney. The complete absence of records for most of the 20th Century resulted in this species being listed as 'presumed extinct' on Part 4 of Schedule 1 of the *BC Act 2016*. In recent years, however, extant populations from north-west of Gosford have been recorded and this area is now the only known area of occurrence of the species. All known plants fall within the Gosford and Wyong Local Government Areas.Grows in Dry sclerophyll woodland and forest with a predominantly grassy understorey.	**Low**. Not detected during the current survey. Associated canopy types occur on site, however, the site is dominated by closed and shrubby understorey. Unlikely to occur due to geographic restriction.	E	-
-	*Epacris purpurascens* var. *purpurascens*	Found in a range of habitat types, most of which have a strong shale soil influence. Flowers in Spring. Lifespan is recorded to be 5-20 years, requiring 2-4 years before seed is produced in the wild. Killed by fire and re-establishes from soil-stored seed. Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South.	**Medium**. Not detected during the current survey. Relatively obvious species. Suitable habitat on site and recorded in LGA and could emerge post bush regeneration or after prescribed mosaic burning. Continued targeted searches to confirm presence.	V	-
Camfield's Stringybark	*Eucalyptus camfieldii*	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Population sizes are difficult to estimate because its extensive lignotubers may be 20m across. A number of stems arise from these lignotubers giving the impression of individual plants. Flowering period is irregular, flowers recorded throughout the year. Poor response to too frequent fires. Restricted distribution in a narrow band with	**Low.** Not detected during the current survey. Very obvious species.	V	V

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		the most northerly records in the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.			
Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire. Tends to grow on lower slopes in the landscape. This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves. Planted as urban trees, windbreaks and corridors.	**Low.** Not detected during the current survey. Very obvious species	V	V
Bauer's Midge Orchid	*Genoplesium baueri*	Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March. The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites.	**Low**. Not detected during the current survey. Surveys during flowering period (February to March) to confirm.	E1,P,2	E
Narrow-leaf Finger Fern	*Grammitis stenophylla*	Grows on rocks in rainforest and in wet sclerophyll forest. Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest. Found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri.	**Low**. Not detected during the current survey. Suitable habitat, rocks and moist shaded areas, present on site. Unlikely to occur due to geographic restriction.	E	-
Caley's Grevillea	*Grevillea caleyi*	Restricted to an 8km square area around Terrey Hills, approximately 20km north of Sydney. Occurs in three major areas of suitable habitat, namely Belrose, Ingleside and Terrey Hills/Duffys Forest within the Ku-ring-gai, Northern Beaches Local Government Areas. All natural remnant sites occur within a habitat that is both characteristic and consistent between sites. All sites occur on the ridgetop between elevations of 170-240m also in association with laterite soils and a vegetation community of open forest, generally dominated by *E. sieberi* and *E. gummifera*. Commonly found in the endangered Duffys Forest ecological community. Killed by fire and relies entirely on seed that is stored in the soil for regeneration.	**Medium.** Not detected during the current survey. Suitable habitat and the Duffy's Forest and associates species on site. No records on site. Currently, understorey is closed and predominantly dominated by *Banksia* sp..Could occur post burn.	E4A, P, 3	E
Small-flower Grevillea	*Grevillea parviflora* ssp. *parviflora*	Sporadically distributed throughout the Sydney Basin. Sizeable populations around Picton, Appin and Bargo (and possibly further south to the Moss Vale area) and in the Hunter at in the Cessnock - Kurri Kurri area	**Low.** Not detected during the current survey. Obvious species. Suitable elevation and	V	V

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		(particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast. Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Soil landscapes include Lucas Heights or Berkshire Park. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Hunter occurrences are usually 30-70m ASL, while the southern Sydney occurrences are typically at 200-300m ASL. Often occurs in open, slightly disturbed sites such as along tracks.	lateritic soils on site. No records from within 5 km of the site.		
Small-flower Grevillea	*Grevillea parviflora* ssp. *supplicans*	Has a very restricted known distribution (approximately 8 by 10 km) and is confined to the north-west of Sydney near Arcadia and the Maroota–Marramarra Creek area, in Hornsby and Baulkham Hills local government areas. It is known from only a few locations, one of which is in the southern portion of Marramarra National Park. Occurs in heathy woodland associations on skeletal sandy soils over massive sandstones. Found at disturbance margins such as trail and road verges where soils are suitable and the availability of light due to clearing has promoted its growth. May be associated with the margins of the Sydney Turpentine Ironbark Forest endangered ecological community and, to a greater extent, with Shale/Sandstone Transition Forest endangered ecological community.	**Low**. Not detected during the current survey. Obvious species. Suitable elevation and lateritic soils on site. No records from within 5 km of the site.	E	-
-	*Grevillea shiressii*	Known only from two populations near Gosford, on tributaries of the lower Hawkesbury River north of Sydney (Mooney Mooney Creek and Mullet Creek). There is also a naturalised population at Newcastle. Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils.	**Low.** Not detected during the current survey. Low suitable habitat. Unliekly to occur due to geographic restrictions. No records from within 5 km of the site.	V	V
-	*Haloragodendron lucasii*	Known locations confined to very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest and with high soil moisture and relatively high soil-phosphorus levels. Reported to grow in moist sandy loam soils in sheltered aspects and on gentle slopes below cliff-lines near creeks in low open woodland. Highly clonal, which implies the true population size may be considerably smaller than expected.	**Low.** Not detected during the current survey. Low suitable habitat on site. No records from within 5 km of the site.	E1	E
-	*Hibbertia puberula*	Is widespread but never common. Extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. Early records are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains. Prefers low heath on sandy soils or rarely in clay, with or without rocks underneath. Habitats are	**Medium.** Not detected during the current survey. Study area contains heathy vegetation. 1 record from within 5 km of the site, >2km north-west of the site.	E1,P	-

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		typically dry sclerophyll woodland communities although heaths are also occupied.			
-	*Hibbertia superans*	Occurs on sandstone ridgetops often near the shale/sandstone boundary. Occurs in both open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides. Occurs from Baulkham Hills to South Maroota in the northern outskirts of Sydney, where there are currently 16 known sites, and at one locality at Mount Boss, inland from Kempsey. No populations are known from a formal conservation reserve.	**Medium.** Not detected during the current survey. The site has some disturbed area and track however vegetation is closed with a heathy and shrubby understory. 1 record from within 5 km of the site, <1km south-east of the site.	E1	-
-	*Kunzea rupestris*	Grows in shallow depressions on large flat sandstone rock outcrops. Characteristically found in short to tall shrubland or heathland. Restricted, with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase National Park, all within the Central Coast botanical subdivision of NSW. Currently known to exist in 20 populations, 6 of which are reserved.	**Low.** Not detected during the current survey. Suitable habitat on site, with a disjunct population in Ku-ring-Gai Chase NP. No records from within 5 km of the site.	V	V
-	*Lasiopetalum joyceae*	Grows in heath on sandstone. Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. It is currently known from 34 sites between Berrilee and Duffys Forest. Seventeen of these are reserved.	**Low**. Not detected during the current survey. Suitable habitat on site. No records from within 5 km of the site.	V	V
-	*Leptospermum deanei*	Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone. Occurs in Riparian Scrub - e.g. Tristaniopsis laurina, Baechea myrtifolia; Woodland - e.g. Eucalyptus haemastoma; and Open Forest - e.g. Angophora costata, Leptospermum trinervium, Banksia ericifolia. Flowers October-November. Probably killed by fire. Occurs in Hornsby, Warringah, Ku-ring-gai and Ryde LGAs.	**Low**. Not detected during the current survey. Some associated species on site but habitat is mostly closed.	V	V
Biconvex Paperbark	*Melaleuca biconvexa*	Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October. Resprouts following fire. Only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.	**Low**. Not detected during the current survey. Very obvious species. Elevation is too high.	V	V
Deane's Paperbark	*Melaleuca deanei*	The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone. Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate. Two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas.	**Low**. Not detected during the current survey. Very obvious species. No preferred habitat onsite. 1 record within 5km.	-	V

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
Angus's Onion Orchid	*Microtis angusii*	Currently only known from one site at Ingleside in the north of Sydney. It is not easy to define the preferred natural habitat of this orchid as the Ingleside location is highly disturbed. The Ingleside population occurs on soils that have been modified but were originally those of the restricted ridgetop lateritic soils in the Duffys Forest - Terrey Hills - Ingleside and Belrose areas. These soils support a specific and distinct vegetation type, the Duffys Forest Vegetation Community which is listed as an endangered ecological community under the BC Act and ranges from open forest to low open forest and rarely woodland. The species exists as subterranean tubers during most of the year. Produces leaves and then flowering stems in late winter and spring and flowers from May to October. By summer, the above ground parts have withered leaving no parts above ground.	**Medium**. Not detected during the current survey. Suitable habitat on site. Known to occur in Duffy's Forest Vegetation Community. 1 record within 5km located in Seaforth. Further surveys during flowering times to confirm presence.	E1,P,2	E
Hairy Geebung	*Persoonia hirsuta*	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. It is usually present as isolated individuals or very small populations. Flowers November to January. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed. Has a scattered distribution around Sydney, from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. Has a large area of occurrence, but occurs in small populations.	**Medium.** Not detected during the current survey. Heathy vegetation on site. Population known to occur 3km north-west of the site.	E1	E
-	*Persoonia mollis* ssp. *maxima*	Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences. Highly restricted, known from the Hornsby Heights-Mt Colah area north of Sydney in the Sydney Basin Bioregion.	**Low**. Not detected during the current survey. Little available habitat in study area. No records within 5km.	E	-
-	*Pimelea curviflora* var. *curviflora*	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Flowers October to May. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Likely to be fire tolerant species capable of resprouting following fire due to the presence of a tap root. Seedlings have been observed following fire. Confined to the coastal area of the Sydney and Illawarra regions. Formerly recorded around the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly.	**Medium.** Not detected during the current survey. Previously recorded <1km south of the site. There are a number of records in the area. Suitable habitat on site, could emerge post bush regeneration or after prescribed mosaic burning. Continued targeted searches over consecutive years and during flowering periods to confirm presence.	V	V
Somersby Mintbush	*Prostanthera junonis*	Has a north-south range of approximately 19km on the Somersby Plateau in the Gosford and Wyong local government areas. Occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. Occurs	**Low**. Not detected during the current survey. No available habitat on site. 3 records <3km south at Seaforth.	E1	E

Common Name	Scientific Name	Habitat preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		in both disturbed and undisturbed sites. Very difficult to identify outside of flowering time.			
Seaforth Mintbush	*Prostanthera marifolia*	Only known from the northern Sydney suburb near Seaforth and has a very highly restricted distribution within the Sydney Basin Bioregion. Total number of populations may be as few as one and fragmented by urbanisation into as few as three small sites. Occurs in localised patches in or in close proximity to the endangered Duffys Forest ecological community. Some plants are located on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised.	**Medium**. Not detected during the current survey. Associated with Duffy's Forest plant community and found in same LGA. Known to occur <3km south in Seaforth. Consecutive surveys over several years to confirm presence on site.	E4A, P, 3	CE
Hartman's Sarcochilus	*Sarcochilus hartmannii*	Occurs from the Richmond River in northern NSW to Gympie in south-east Queensland. Favours cliff faces on steep narrow ridges supporting eucalypt forest and clefts in volcanic rock from 500 to 1,000m in altitude. Also found occasionally at the bases of fibrous trunks of trees, including cycads and grass-trees.	**Low**. Not detected during the current survey. Low elevation. No available habitat on site. 1 record within 5km.	V,P,2	V
Magenta Lilly Pilly	*Syzygium paniculatum*	On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. The Magenta Lilly Pilly is naturally found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest.	**Low**. Not detected during the current survey. No available habitat on site. 4 records within 5km.	E1	V
-	*Tetratheca glandulosa*	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Found in various vegetation structures from heaths and scrub to woodlands/open woodlands, and open forest. Flowers July-November however residual flowers may persist until late December. Restricted to the following LGAs: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong.	**Medium**. Not detected during the current survey. 4 records within 500m of the site. Suitable habitat on site, could emerge post bush regeneration or after prescribed mosaic burning. Continued targeted searches over consecutive years and during flowering periods to confirm presence.	V	-

Table 12-2 Likelihood of occurrence of threatened fauna species on the site

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
Regent Honeyeater	*Anthochaera phrygia*	Mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Also found in drier coastal woodlands and forests. Foraging: A generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Insects make up 15% of diet. Breeding: August - February. There are only three known key breeding regions remaining: two in NSW at Capertee Valley and the Bundarra-Barraba region. Relevant threats: Competition from larger aggressive honeyeaters, particularly Noisy Miners, Noisy Friarbirds and Red Wattlebirds.	**High.** No recorded during the current survey. Foraging habitat on site. No records within 5km. Does not breed in Sydney.	E4A	CE
Fork-tailed Swift	*Apus pacificus*	Summer migrant, October to April. Mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. Also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes and sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines. In NSW, the Fork-tailed Swift is recorded in all regions. Foraging: Almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In flocks, rarely one or two individuals. Sleeps in high circling flocks. Breeding: Siberia to Japan and Asia.	**High**. Not detected during the current survey. Air space above the site contains general foraging habitat as does most habitats in NSW. Highly mobile species. Likely to be part of a large home-range when in Australia. Does not breed in Australia	-	C,J,K
Cattle Egret	*Ardea ibis*	Occurs in tropical and temperate grasslands, wooded lands, terrestrial wetlands, stock paddocks, pastures, croplands, garbage tips, and drains. Widespread and common according to migration movements and breeding localities surveys. One of the two major distributions is in south-eastern Australia. Colonised Australia (probably from Indonesia) in the 1940's as part of a worldwide expansion. Foraging: Insect feeder. Breeding: November to January in swamp woodlands, usually in a group.	**Low**. Not recorded during the current survey. No suitable habitat onsite. No records within 5kms of the site.	-	M
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. Also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland. Foraging: Primarily eats invertebrates, which are captured whilst hovering or sallying above the canopy. Breeding: August to January. Generally breed in solitary pairs. Nest is a scanty of	**Low.** Not recorded during current survey. Six (6) sighting within 5km of the site. Recorded in the 1980s. Not preferred habitat. Usually prefers more open habitat.	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		twigs, 1-20m high on a horizontal branch/fence post. Relevant threats: Aggressive exclusion by over abundant noisy miners.			
Bush Stone-curlew	*Burhinus grallarius*	Found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Behaviour: Largely nocturnal, being especially active on moonlit nights. Foraging: Nocturnal feeders, feeding on insects, molluscs, small lizards, seeds and occasionally small mammals. During breeding season they feed with in the nesting site but will travel long distances to feed at other times of the year. Breeding: August – January on the ground in a scrape or small bare patch. Threats: Predation by foxes and cats, trampling of eggs by cattle, clearance of woodland habitat, modification and destruction of ground habitat and disturbance of nest sites.	**Low**. Not recorded during current survey. 3 sighting within 5km of the site. Recorded from 1998 to 2008. Not preferred habitat. Usually prefers more open habitat.	E1	-
Gang-gang Cockatoo	*Callocephalon fimbriatum*	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands,particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Breeding: Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Relevant threats: Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.	**Low**. Not recorded during current survey. Would most likely be in the area during Autumn and Winter. No records within 5km of the site. Not preferred habitat. Usually prefers more open habitat.	V	-
Gang-gang Cockatoo	*Callocephalon fimbriatum* population in the Hornsby and Ku-ring-gai Local Government Areas	This endangered population is found in the Ku-ring-gai and Hornsby local government areas. The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area.In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands,particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Breeding: Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that	**Low**. Not recorded during current survey. 10 sightings within 5km of the site. Recorded from 1998 to 2008. Not preferred habitat. Usually prefers more open habitat.	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Relevant threats: Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.			
Glossy Black Cockatoo	*Calyptorhynchus lathami*	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000m in which stands of she-oak species, particularly Black She-oak (Allocasuarina littoralis), Forest She-oak (A. torulosa) or Drooping She-oak (A. verticillata) occur. Foraging: Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species). Breeding: March – August. Dependent on large hollow-bearing eucalypts for nest sites. Relevant threats: Nest raids by feral cats and possums. Competition for nests from Galahs and introduced honey bees	**High**. Not recorded during current survey. 17 sightings recorded within 5km. Closest recorded sighting is <90m south. Nesting habitat available and their food source, Black She-oaks are found on site. Threats from cats and possums are present on site.	V	-
Eastern Pygmy-possum	*Cercartetus nanus*	Found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Foraging: Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelter: in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (Pseudocheirus peregrinus) dreys or thickets of vegetation, (e.g. grass-tree skirts). Frequently spends time in torpor especially in winter, with body curled, ears folded and internal temperature close to the surroundings. Nesting: Nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Breeding: Mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares. Behaviour: Frequently spends time in torpor especially in winter, with body curled, ears folded and internal temperature close to the surroundings.	**Occurs on connecting bushland within the study area.** Confirmed photos from camera trap of at least 1 individual.	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
Large-eared Pied Bat	*Chalinolobus dwyeri*	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosting: In caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Likely to hibernate through the coolest months. Breeding: Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. It is uncertain whether mating occurs early in winter or in spring. Found in well-timbered areas containing gullies. The Foraging: probably for small, flying insects below the forest canopy due to their relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight.	**Occurs onsite.** Confirmed acoustic recordings on 2 of the 7 recorded nights.	V	V
Varied Sittella	*Daphoenositta chrysoptera*	Sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Foraging behaviour: more active and acrobatic among branches than the larger tree creepers. They fly into the heads of trees, typically working their way down branches and trunk with constant motion. Breeding: July – December. Cup-shaped nest in a tree fork, often use the same fork or tree for successive years. Relevant threats: adversely affected by the dominance of Noisy Miners in woodland patches.	**Medium.** Not recorded during the current survey. 1 recorded sightings within 5km of the site. The closest is 2.7km north-east of the site Suitable habitat on site included mature smooth-barked gums.	V	-
Eastern Bristlebird	*Dasyornis brachypterus*	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species. The Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, habitat in northern NSW requires frequent fires to maintain habitat condition and suitability. The northern fire regimes is between 3-6 years and of variable intensity depending on the habitat condition.	**Low.** Not recorded during current survey. No recorded sightings within 5km of the site. No preferred habitat on site.	E1	E

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		Behaviour: Shy and cryptic and rarely flies, although can be seen scampering over the ground; when approached, may move to a lookout perch 1 m or more above the ground, then retreat into dense vegetation. Foraging: Feeds on a variety of insects, particularly ants.Breeding: Nests are elliptical domes constructed on or near the ground amongst dense vegetation. Two eggs are laid during August to February; producing more than one clutch a year is rare, and recruitment into the population is low.Males are strongly territorial.			
Spotted-tail Quoll	*Dasyurus maculatus*	Habitats include: rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites: use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces. Behaviour: Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Large home ranges (Fe up to 750 ha, Ma up to 3,500ha). Known to traverse their home ranges along densely vegetated creeklines. Foraging: generalist predator with a preference for medium-sized (0.5kg – 5kg) mammals. Breeding: April – July. Relevant threats: Foxes and cats prey on quolls and also compete with them for food.	**Medium.** Not recorded during current survey, but rarely detected during survey. 10 recorded sightings within 5km of the site. The closest sighting is within 500m of the site. Habitat for den sites and prey species on site.	V	E
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Prefers moist habitats, with trees taller than 20 m. Roost: Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Foraging: Hunts insects above or just below the canopy. Winter behaviour: hibernates. Breeding: Females are pregnant in late spring to early summer.	**Medium.** Not recorded during current survey. No records within 5km of the site. Drier habitat than preferred although roosting habitat available.	V	-
Little Lorikeet	*Glossopsitta pusilla*	Widely distributed across the coastal and Great Divide regions of eastern Australia. Nomadic movements are common, influenced by season and food availability. Foraging: primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Roosts: in treetops, often distant from feeding areas Breeding: May – September. Most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m).	**High.** Not recorded during current survey. 2 recorded sightings within 5km of the site. The closest 2.5km north-east of the site. Foraging and roosting habitat on site.	V	-
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Found in coastal habitats and around terrestrial wetlands. Habitats occupied by the sea-eagle are characterised by the presence of large areas of open water. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest (including rainforest) and even urban	**Medium.** Was not recorded during the current survey. 23 recorded sightings within 5km. No suitable foraging or	V	C

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		areas. Foraging: generally forages over large expanses of open water; also forage over open terrestrial habitats Behaviour: generally seen singly or in pairs. Hunts its prey from a perch or whilst in flight. Breeding: June to September. Relevant threats: Increased mortality or reduced breeding success due to non-target poisoning during vertebrate pest control, exposure to industrial chemicals and pesticides.	roosting habitat on site. May forage over Manly Dam to the south-east.		
Giant Burrowing Frog	*Heleioporus australiacus*	Exists as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Habitat: Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Behaviour: Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Breeding: mainly in autumn, but has been recorded calling throughout the year.	**Medium**. Not recorded during current survey. 7 recorded sightings within 5km of the site. Some preferred habitat on site.	-	V
Little Eagle	*Hieraaetus morphnoides*	Occurs as a single population throughout NSW through open eucalypt forest, woodland or open woodland. Also used are She-oak or acacia woodlands and riparian woodlands of interior NSW. Foraging: Generalist predator Breeding: Pairs build a large stick nest in winter in tall living trees within a remnant patch of vegetation. Relevant threats: Secondary poisoning from rabbit baiting.	**Medium.** Not recorded during current survey. 1 recorded sightings within 5km of the site. Closest sighting 4km south-west. No preferred habitat on site, but site may be part of a large home range.	V	-
White-throated Needletail	*Hirundapus caudacutus*	Occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest, heathlands and rainforest but less often over treeless areas, such as grassland or swamps. Roosts: in trees in forests and woodlands, both among dense foliage in the canopy or in hollows. It has been suggested that they also sometimes roost aerially. Breeding: This species does not breed in Australia.	**High.** Not detected during the current survey. Air space above the site contains general foraging habitat as does most habitats in NSW. Highly mobile species. Likely to be part of a large home-range when in Australia. Does not breed in Australia	-	C,J,K
Southern Brown Bandicoot (Eastern)	*Isoodon obesulus obesulus*	Patchy distribution. It is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River. Behaviour: largely crepuscular (active mainly after dusk and/or before dawn). Generally only found in heath or open forest with a heathy understorey on sandy or friable soils. Foraging: feed on a variety of ground-dwelling invertebrates and the fruit-bodies	**High**. Not detected during the current survey. 3 recorded sightings within 5km. Preferred habitat onsite.	E1	E

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		of hypogeous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil. Breeding: Males have a home range of approximately 5-20 hectares whilst females forage over smaller areas of about 2-3 hectares. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees Xanthorrhoea spp., blackberry bushes and other shrubs, or in rabbit burrows. The upper surface of the nest may be mixed with earth to waterproof the inside of the nest.Mating occurs any time of the year, usually following heavy rain.			
Swift Parrot	*Lathamus discolor*	Migrates to SE Aust between March – October. Preferred non-breeding habitat is woodlands and riparian vegetation where there are winter flowering eucalypts such as the Swamp Mahogany, Eucalyptus robusta in coastal areas. Breeding: September to January in Tasmania. Relevant threats: Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners	**Low**. Not detected recorded during the current survey. No suitable foraging habitat on site. No preferred roosting habitat. Breeds in Tasmania.	E1	CE
Green and Golden Bell Frog	*Litoria aurea*	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spike rushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. Behaviour: active by day Breeding: in summer when conditions are warm and wet Relevant threats: predation by feral animals such as foxes.	**Low.** Was not recorded during the current survey. Low quality habitat that is too disturbed on site.	E	V
Square-tailed Kite	*Lophoictinia isura*	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Foraging: a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy. Appears to occupy large hunting ranges of more than 100km2 Breeding: July to February. Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	**Occurs onsite.** Confirmed sighting in nearby area	V,P,3	-
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Behaviour: gregarious species usually seen in pairs and small groups of up to 12	**Low.** Not detected during the current survey. No preferred habitat on site.	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		birds Foraging: locally nomadic Breeding: June to December. Solitarily or co-operatively, with up to five or six adults. Cap-shaped nest placed high in the crown of a tree. Relevant threats: May be excluded from smaller remnants by aggressive species such as the Noisy Miner			
Rainbow Bee-eater	*Merops ornatus*	Mainly in open forests and woodlands, shrublands, including mallee and dominated by eucalypts. Also found in various cleared or semi-cleared habitats, including farmland and areas of human habitation. Usually located in close proximity to permanent water. Occurs in inland and coastal sand dune systems, and in mangroves in northern Australia. Has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches. Also occurs in grasslands and, especially in arid or semi-arid areas, in riparian, floodplain or wetland vegetation assemblages. Foraging: mainly feeds on insects, will occasionally take other animal items including earthworms, spiders and tadpoles. The insect component of the diet mainly consists of bees and wasps, but also includes various other insects such as beetles, moths, butterflies, damselflies, dragonflies, flies, ants and bugs. Forages from open perches, from which it may scan for prey that it catches in flight.	**Low.** Not detected during the current survey. No preferred habitat on site. No recorded sightings within 5km of the site.	-	M
Little Bentwing-bat	*Miniopterus australis*	Prefer moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roosts: by day in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings. Foraging: at night forage for small insects beneath the canopy of densely vegetated habitats. Breeding: Only five nursery sites /maternity colonies are known in Australia.	**Confirmed onsite.** Acoustic recordings obtained from anabat recordings on site	V	-
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	Roosts: Caves are the primary roosting habitat but also use man-made structures. Breeding: Spring and Summer. Form discrete populations centered on large maternity caves. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Foraging: in forested areas, catching flying insects above the canopy. Behaviour: Cold caves are used for hibernation in southern Australia.	**Confirmed onsite.** Acoustic recordings obtained from anabat recordings on site.	V	-
Eastern Freetail-bat	*Mormopterus norfolkensis*	Dry sclerophyll forest and woodland east of the Great Dividing Range from south Queensland to southern NSW.	**Possibly occurs onsite**. Possible acoustic recordings	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		Roosts: mainly in tree hollows of mature Mangroves and mature Eucalypts but will are also found roosting under bark or in man-made structures. Behaviour: generally solitary Foraging: probably insectivorous Relevant threats: artificial light sources spilling onto foraging and/or roosting habitat.	obtained from anabat recordings on site		
Southern Myotis	*Myotis macropus*	Rarely found more than 100 km inland, except along major rivers. Foraging: over streams and pools catching insects and small fish by raking their feet across the water surface. Roosts: in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Breeding: November or December.	**Possibly occurs onsite.** Possible acoustic recordings obtained from anabat recordings on site	V	-
Turquoise Parrot	*Neophema pulchella*	Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Behaviour: Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Foraging: Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. If flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nesting: in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	**Low.** Was not recorded during the current survey. No suitable foraging or roosting habitat on site. No recorded sightings within 5km	V	-
Barking Owl	*Ninox connivens*	Eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Dense vegetation is used occasionally for roosting. Foraging: variety of prey, with invertebrates predominant for most of the year, and birds and mammals becoming important during breeding. Monogamous pairs hunt over as much as 6000 ha, with 2000 ha being more typical in NSW habitats. Breeding: Begins mid-winter and spring. Nests in hollows of large, old living eucalypts. Laying during August and fledging in November.	**Medium**. Not detected during the current survey. The site contains suitable roosting habitat, and foraging habitat and prey species. Highly mobile species. Possibly part of a large home-range. No records within 5km of the site.	V	-
Powerful Owl	*Ninox strenua*	Endemic to eastern and south-eastern Australia. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest and requires large tracts of forest or woodland habitat but can occur in fragmented landscapes. Foraging: medium arboreal mammals in open or closed sclerophyll forest or	**High.** Known to inhabit the area. Suitable roosting and foraging habitat and prey recorded on site. Note recorded in the current survey.	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		woodlands Roosts: by day in dense vegetation Breeding: late autumn to mid-winter in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old Behaviour: monogamous and mate for life Relevant threats: Predation of fledglings by foxes, dogs and cats, and secondary poisoning			
Squirrel Glider	*Petaurus norfolcensis*	Occur in a broad band from Cape York Peninsula (Qld) to central Victoria, extending to the coastal side of the Great Dividing Range between southern Qld and central NSW. They are more abundant in coastal forests of northern NSW and south-eastern Qld than inland of the Great Dividing Range or in southern parts of its range. They inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Foraging: Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	**Medium**. Suitable foraging and nesting habitat on site. No records within 5km	V	-
Scarlet Robin	*Petroica boodang*	Dry eucalypt forests and woodlands where the understorey is usually open and grassy with few scattered shrubs. Both mature and regrowth vegetation. Occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps.In autumn and winter may live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. Important feature: habitat usually contains abundant logs and fallen timber Foraging: from low perches, fence-posts or on the ground for invertebrates Breeding: July – January on ridges hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. Pairs defend a breeding territory. Open cup made of plant fibres and cobwebs and is built in the fork Relevant threats: Predation by over-abundant populations of Pied Currawong (Strepera graculina) and feral cats. Competitive exclusion by over-abundant Noisy Miners.	**Medium.** Was not recorded during the current survey. Moderately suitable foraging habitat on site. 2 recorded sightings within 5km. The closest sighting <1km east of the site in 2007.	V	-
Koala	*Phascolarctos cinereus*	Eucalypt woodlands and forests. The only known Sydney population is in Campbelltown LGA. Behaviour: Inactive for most of the day, feeding and moving mostly at night. Foraging: Needs a large number of preferred food tree species, this differs depending on the region.	**Low**. Not detected during the current survey. Last recorded sighting in the area was 1997 <3km north-west of the site.	E2, V	V

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
Koala	*Phascolarctos cinereus in the Pittwater Local Government Area*	Has a fragmented distribution throughout eastern Australia, from north-east Queensland to the Eyre Peninsula in South Australia, extending west of the Great Dividing Range where it mostly occurs along inland rivers. The endangered population occurs within the Pittwater Local Government Area, with most recent records occurring on the Barrenjoey Peninsula. The last recorded sighting in the Pittwater area was 2010. Inhabits eucalypt forests and woodlands. Habitat suitability is influenced by the: size and species of trees present, soil nutrients, climate, rainfall and the size and disturbance history of the habitat patches. The Grey Gum (Eucalyptus punctata) is the most important food tree for this species in Pittwater. Other favoured food trees are the Scribbly Gum (E. haemastoma), Swamp Mahogany (E. robusta) and Snappy Gum (E. racemosa). Generally koalas can be expected to feed to a limited extent on all species of Eucalyptus, Corymbia and Angophora that they encounter in Pittwater. Key likely habitats within Pittwater Council are: Swamp Mahogany Forest, ecotone between Spotted Gum Forest & Hawkesbury Sandstone Open-Forest, Northern form of Coastal Sandstone Woodland at Whale Beach, Red Bloodwood - Scribbly Gum Woodland, Bilgola Plateau Forest and the Grey Ironbark - Grey Gum form of the Newport Bangalay Woodland. Breeding: Most females breed towards the end of their second year with mating occurring between September and February.	**Low**. Not detected during the current survey. Last recorded sighting in the area was 1997 <3km north-west of the site.	E2, V	V
Superb Parrot	*Polytelis swainsonii*	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. Breeding: September to January. Hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. Nests in small colonies. Foraging: diet consists mainly of grass seeds and herbaceous plants. May forage up to 10 km from nesting sites, primarily in grassy box woodland.	**Low**. Was not recorded during the current survey. No suitable foraging or roosting habitat on site. No records within 5km.	V	V
New Holland Mouse	*Pseudomys novaehollandiae*	Fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. The species is known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. The species peaks in abundance during early to mid stages of vegetation succession typically induced by fire. Behaviour: It is a social animal, living predominantly in burrows shared with other individuals.	**Low**. Was not recorded during the current survey. No suitable habitat on site no records within 5km of the site.	-	V
Red-crowned Toadlet	*Pseudophryne australis*	Open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale	**High.** Was not recorded during the current survey. Suitable habitat on	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		lenses or cappings. Sheltering: under rocks and amongst masses of dense vegetation or thick piles of leaf litter Breeding: congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Eggs are laid in moist leaf litter. Disperses outside the breeding period.	site. A high number or records within 5km. The closest <100m north of the site.		
Grey-headed Flying-fox	*Pteropus poliocephalus*	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps: generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy Breeding: Annual mating commences in January and conception occurs in April or May; a single young is born in October or November Foraging: Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km	**Occurs onsite.** Confirmed sightings of 5 individuals flying over-head.	V	V
Wompoo Fruit-Dove	*Ptilinopus magnificus*	Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. Rare south of Coffs Harbour. Three subspecies are recognised, with the most southerly in NSW and south-eastern Queensland. Most often seen in mature forests, but also found in remnant and regenerating rainforest. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeding: on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit. Feeds alone, or in loose flocks at any height in the canopy. Despite its plumage, can be remarkably cryptic as it feeds, with the call and falling fruit being an indication of its presence. The nest is a typical pigeon nest - a flimsy platform of sticks on a thin branch or a palm frond, often over water, usually 3 - 10 m above the ground. Breeding: spring and early summer	**Low**. Was not recorded during the current survey. No suitable foraging or roosting habitat on site. No records within 5km.	V	-
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Roosts: singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Breeding: December to mid-March Foraging: most habitats across its very wide range, with and without trees; appears to defend an aerial territory Behaviour: Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	**Medium.** Not detected during the current survey. Suitable roosting habitat on site. Site may be part of home range. No records within 5km of the site.	V	-
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Mainly in the gullies and river systems that drain the Great Dividing Range. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Does not occur at altitudes above 500 m.	**Possibly occurs onsite.** Possible acoustic recordings obtained from anabat recordings on site.	V	-

Common Name	Scientific Name	Habitat Preference	Likelihood of Occurrence	BC Act Status	EPBC Act Status
		Roosts: tree hollows, it has also been found in buildings Foraging: Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for insects. Breeding: Little is known of its reproductive cycle, however a single young is born in January			
Masked Owl	*Tyto novaehollandiae*	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. Foraging: often hunts along the edges of forests, including roadsides. Typical diet consists of tree-dwelling and ground mammals, especially rats. Breeding and roosts: in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Pairs have a large home-range of 500 to 1000 hectares.	**Medium**. Not detected during current survey. Foraging habitat and prey species on site. No roosting or breeding habitat. No records within 5km	V	-
Sooty Owl	*Tyto tenebricosa*	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Behaviour: Roosts by day in the hollow of a tall forest tree or in heavy vegetation. Territories are occupied permanently. Breeding: Nests in very large tree-hollows. Foraging: Hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum	**Low**. Not detected during the current survey. No suitable foraging or roosting habitat on site. 2 records within 5km	V	-
Rosenberg's Goanna	*Varanus rosenbergi*	Occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. Records from the South West Slopes near Khancoban and Tooma River. Also occurs in South Australia and Western Australia. Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Individuals require large areas of habitat. Feeds on carrion, birds, eggs, reptiles and small mammals. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Runs along the ground when pursued (as opposed to the Lace Monitor, which climbs trees). Lays up to 14 eggs in a termite mound; the hatchlings dig themselves out of the mounds. Generally slow moving; on the tablelands likely only to be seen on the hottest days.	**High.** Not recorded during the current survey. Suitable foraging habitat. 20+ recorded sightings to the north of the site. The closest record is <1km south of the site.	V	-

13 Appendix D. Microbat Call Analysis Expert Report

14 Appendix E. Flora species surveyed onsite

Table 14-1 Flora species surveyed onsite

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status
Fabaceae (Mimosoideae)		*Acacia longifolia*	-		
Fabaceae (Mimosoideae)		*Acacia parramattensis*	Parramatta Wattle		
Fabaceae (Mimosoideae)		*Acacia suaveolens*	Sweet Wattle		
Apiaceae		*Actinotus minor*	Lesser Flannel Flower		
Myrtaceae		*Angophora crassifolia*	-		
Poaceae		*Anisopogon avenaceus*	Oat Speargrass		
Proteaceae		*Banksia ericifolia*	Heath-leaved Banksia		
Proteaceae		*Banksia oblongifolia*	Fern-leaved Banksia		
Proteaceae		*Banksia serrata*	Old-man Banksia		
Cunoniaceae		*Bauera rubioides*	River Rose		
Pittosporaceae		*Billardiera scandens*	Hairy Apple Berry		
Rutaceae		*Boronia ledifolia*	Sydney Boronia	P	
Myrtaceae		*Callistemon linearis*	Narrow-leaved Bottlebrush		
Dicksoniaceae		*Calochlaena dubia*	Rainbow Fern		
Lauraceae		*Cassytha glabella*	-		
Cyperaceae		*Caustis pentandra*	Thick Twist Rush	P	
Myrtaceae		*Corymbia gummifera*	Red Bloodwood		
Cyperaceae		*Cyathochaeta diandra*	-		
Goodeniaceae		*Dampiera stricta*	-		
Phormiaceae		*Dianella caerulea* var. *producta*	-		
Poaceae		*Entolasia* spp.	-		
Myrtaceae		*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum		
Myrtaceae		*Eucalyptus punctata*	Grey Gum		
Myrtaceae		*Eucalyptus sieberi*	Silvertop Ash		
Cyperaceae		*Gahnia* spp.	-		
Proteaceae		*Hakea gibbosa*	-		
Euphorbiaceae		*Homalanthus populifolius*	-		
Poaceae		*Imperata cylindrica*	Blady Grass		
Proteaceae		*Lambertia formosa*	Mountain Devil		
Verbenaceae	*	*Lantana camara*	Lantana		
Malvaceae		*Lasiopetalum ferrugineum*	-		
Myrtaceae		*Leptospermum polygalifolium*	-		
Myrtaceae		*Leptospermum squarrosum*	Pink Tea-tree		
Lomandraceae		*Lomandra longifolia*	Spiny-headed Mat-rush		
Lomandraceae		*Lomandra obliqua*	-		
Proteaceae		*Lomatia silaifolia*	Crinkle Bush	P	
Euphorbiaceae		*Micrantheum ericoides*	-		

Myrtaceae		*Micromyrtus ciliata*	Fringed Heath-myrtle		
Ochnaceae	*	*Ochna serrulata*	Mickey Mouse Plant		
Pittosporaceae		*Pittosporum revolutum*	Rough Fruit Pittosporum		
Pittosporaceae		*Pittosporum undulatum*	Sweet Pittosporum		
Apiaceae		*Platysace linearifolia*	-		
Fabaceae (Caesalpinioideae)	*	*Senna pendula* var. *glabrata*	-		
Smilacaceae		*Smilax glyciphylla*	Sweet Sarsparilla		
Xanthorrhoeaceae		*Xanthorrhoea media*	-	P	
Fabaceae (Mimosoideae)		*Acacia ulicifolia*	Prickly Moses		
Asteraceae	*	*Ageratina adenophora*	Crofton Weed		
Sapindaceae		*Alectryon tomentosus*	Hairy Bird's Eye		
Casuarinaceae		*Allocasuarina distyla*	-		
Poaceae	*	*Andropogon virginicus*	Whisky Grass		
Myrtaceae		*Angophora hispida*	Dwarf Apple		
Arecaceae		*Archontophoenix cunninghamiana*	Bangalow Palm	P	
Asparagaceae	*	*Asparagus aethiopicus*	Asparagus Fern		
Poaceae	*	*Axonopus* sp.	-		
Proteaceae		*Banksia spinulosa*	Hairpin Banksia	P	
Rutaceae		*Boronia pinnata*	-	P	
Myrtaceae		*Callistemon rigidus*	Stiff Bottlebrush		
Gentianaceae	*	*Centaurium tenuiflorum*	Branched Centaury, Slender centaury		
Apiaceae		*Centella asiatica*	Indian Pennywort		
Asteraceae	*	*Cirsium vulgare*	Spear Thistle		
Commelinaceae		*Commelina cyanea*	Native Wandering Jew		
Rutaceae		*Crowea saligna*	-	P	
Cyatheaceae		*Cyathea cooperi*	Straw Treefern	P	
Poaceae		*Cynodon dactylon*	Common Couch		
Cyperaceae	*	*Cyperus eragrostis*	Umbrella Sedge		
Phormiaceae		*Dianella caerulea*	Blue Flax-lily		
Poaceae	*	*Ehrharta erecta*	Panic Veldtgrass		
Elaeocarpaceae		*Elaeocarpus reticulatus*	Blueberry Ash		
Cyperaceae		*Eleocharis gracilis*	-		
Ericaceae		*Epacris microphylla*	Coral Heath		
Ericaceae		*Epacris pulchella*	Wallum Heath		
Orchidaceae	*	*Epidendrum radicans* x *secundum* hybrid complex	Crucifix Orchid		
Poaceae		*Eragrostis brownii*	Brown's Lovegrass		
Poaceae	*	*Eragrostis curvula*	African Lovegrass		
Myrtaceae		*Eucalyptus capitellata*	Brown Stringybark		

Myrtaceae		*Eucalyptus sparsifolia*	Narrow-leaved Stringybark		
Gleicheniaceae		*Gleichenia dicarpa*	Pouched Coral Fern		
Phyllanthaceae		*Glochidion ferdinandi*	Cheese Tree		
Haloragaceae		*Gonocarpus teucrioides*	Germander Raspwort		
Proteaceae		*Grevillea speciosa*	Red Spider Flower		
Proteaceae		*Hakea dactyloides*	Finger Hakea		
Proteaceae		*Hakea teretifolia*	Needlebush		
Lamiaceae		*Hemigenia purpurea*	-		
Dilleniaceae		*Hibbertia aspera*	Rough Guinea Flower		
Myrtaceae		*Kunzea ambigua*	Tick Bush	P	
Myrtaceae		*Kunzea capitata*	-	P	
Cyperaceae		*Lepidosperma laterale*	-		
Myrtaceae		*Leptospermum trinervium*	Slender Tea-tree		
Oleaceae	*	*Ligustrum sinense*	Small-leaved Privet		
Lindsaeaceae		*Lindsaea linearis*	Screw Fern		
Lomandraceae		*Lomandra glauca*	Pale Mat-rush		
Lomandraceae		*Lomandra gracilis*	-		
Caprifoliaceae	*	*Lonicera japonica*	Japanese Honeysuckle		
Poaceae		*Microlaena stipoides*	Weeping Grass		
Poaceae		*Oplismenus aemulus*	-		
Poaceae		*Paspalidium distans*	-		
Poaceae	*	*Paspalum dilatatum*	Paspalum		
Poaceae	*	*Paspalum quadrifarium*	Tussock Paspalum		
Proteaceae		*Persoonia lanceolata*	Lance Leaf Geebung	P	
Proteaceae		*Persoonia levis*	Broad-leaved Geebung	P	
Proteaceae		*Petrophile pulchella*	Conesticks	P	
Fabaceae (Faboideae)		*Pultenaea tuberculata*	-		
Rosaceae	*	*Rubus fruticosus* sp. agg.	Blackberry complex		
Goodeniaceae		*Scaevola ramosissima*	Purple Fan-flower		
Poaceae	*	*Setaria parviflora*	-		
Solanaceae	*	*Solanum mauritianum*	Wild Tobacco Bush		
Poaceae	*	*Stenotaphrum secundatum*	Buffalo Grass		
Stylidiaceae		*Stylidium lineare*	Narrow-leaved Triggerplant		
Elaeocarpaceae		*Tetratheca thymifolia*	Black-eyed Susan		
Orchidaceae		*Thelymitra ixioides* var. *ixioides*	Dotted Sun Orchid	P	
Iridaceae	*	*Watsonia meriana*	-		

15 Appendix F. Fauna species surveyed onsite

Table 15-1 Fauna species surveyed onsite

Common name	Scientific name	BC Act status	EPBC Act status	Observation type
Red Wattlebird	*Anthochaera carunculata*	P		O
White-striped Free-tail Bat	*Austronomus australis*			AR
Eastern Pygmy-possum	*Cercartetus nanus*	V		Q
Large-eared Pied Bat	*Chalinolobus morio*			AR
Gould's Wattled Bat	*Chalinolobus gouldii*	P		AR
Common Eastern Froglet	*Crinia signifera*	P		O, W
Kookaburra	*Dacelo novaeguineae*			O
Australian Magpie	*Gymnorhina tibicen*	P		O
Striped marsh frog (call)	*Limnodynastes peronii*			W
Square-tailed Kite	*Lophoictinia isura*	V		O
Noisy Miner	*Manorina melanocephala*	P		O
Common Dwarf Skink	*Menetia greyii*	P		O
Little Bentwing-bat	*Miniopterus australis*	V		AR
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V		AR
Rabbit	*Oryctolagus cuniculus*	U		O
Yabby (in Southern creek)	*Parastacidae* family			O
Sugar Glider	*Petaurus breviceps*	P		Q
Common Ringtail Possum	*Pseudocheirus peregrinus*	P		O
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	O
Black Rat	*Rattus rattus*	U		O
Pied Currawong	*Strepera graculina*	P		O
Rainbow Lorikeet	*Trichoglossus haematodus*	P		O
Common Brushtail Possum	*Trichosurus vulpecula*	P		Q
Large Forest Bat	*Vespadelus darlingtoni*			AR
Little Forest Bat	*Vespadelus vulturnus*	P		AR
Fox	*Vulpes vulpes*	U		Q
Swamp Wallaby	*Wallabia bicolor*	P		O

[1] E4A – critically endangered; E1 – endangered species; V – vulnerable.
[2] CE - critically endangered; E – endangered; V – vulnerable
[3] AR - Acoustic Recording; F – scratching; O - Observed, Q - Camera trap, W – Aural recognition

16 Appendix G: Plot field data sheets

PAGE # 1/1

GPS POINT DATA SHEET

SITE NAME 181 Allambie	VEGETATION TYPE Ranthy Woodland
DATE 21/2/18	WEATHER/TEMPERATURE Overcast 19°C No breeze
RECORDER DP GL	TIME 7:00 – 2:00 ~24°C

POINT #	NAME	DESCRIPTION
881		Plot 1 start
882		Plot 1 end
883		Plot 2 start
884		Plot 2 end
885		Plot 3 start
886		Plot 3 end
887		Aboriginal Stone?
888		pond
889		pond centre
891		culvert
892		Plot 4 start
893		Plot 4 End
894		Plot 5 start
895		Plot 5 End
896		culvert
897		culvert

22nd: 8:00 – 20°C – 26°C
overcast slight south breeze

Plot 1 Sheet 1 ①

BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	21/02/18	181 Allambie					
Zone	Datum	Plot ID		Plot dimensions	20×50	Photo #	
56 H	GDA 94						
Easting	Northing	IBRA region	Sydney Basin	Midline bearing from 0 m	98° East	Magnetic?	
337438	6263089						
Vegetation Class						Confidence: H M L	
Plant Community Type		Urban Exotic / Native		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha back plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		0
50 – 79 cm		
30 – 49 cm	1	
20 – 29 cm	𝍸 𝍸 𝍸 𝍸 𝍸 1	
10 – 19 cm	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 111	
5 – 9 cm	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 1	
< 5 cm	1111	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 1111	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30...., 100, 200, 300....). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	95 50 100 5 25	2 20 0 20 70	0 0 40 0	2 15 0 15 5
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern	gentle slope	Microrelief	
Lithology		Soil Surface Texture	sandy	Soil Colour		Soil Depth	2cm
Slope		Aspect	south	Site Drainage	drainage line	Distance to nearest water and type	200m gully

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	3	R	mostly managed area
Cultivation (inc. pasture)	0		
Soil erosion	2		tracks, drainage line
Firewood / CWD removal	0		
Grazing (identify native/exotic)	0		
Fire damage	0		
Storm damage	1	R	
Weediness	3	R	infested along riparian
Other	2	R	rabbits grazing / mowing

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date __/__/__		Plot 9	

GF Code		Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1	E- [illegible]	HTE	40	30	G	
	2	K. ambigua	N	40	30	M	
	3	Lantana	HTE	5	15	M	
	4	Crofton	E	1	20	G	
	5	P- quadrifarium	E	10	30	G	
	6	P. dilatatum	E	2	10	G	
	7	D- [illegible]	N	1	1	G	
	8	L- japonica	HTE	1	20	G	
	9	Cirsium vulgare (thistle)	E	0.1	1	G	
	10	Couch	E	.5	100+	G	
	11	D- [illegible]	E	15	200	G	
	12	Blady	N	2	10	G	
	13	Wild tobacco	E	5	2	G	
	14	Paspalidium distans	N	15	2	G	✓
	15	Dianella caerulea	N	1	5	G	
	16	[illegible]	N	0.1	50	G	
	17	Oplismenus aemulus	N	0.1	50	G	
	18	Pitto	N	.2	5	M	
	19	Poa ?	N	0.1	5	G	✓
	20	Carpet grass (Axonopus sp.)	N	1	10	G	
	21	A- longifolia	N	1	5	M	
	22	Asparagus fern	E	0.1	5	G	
	23	L. sinense	HTE	0.2	2	M	
	24	Ochna	E	0.1	5	G	
	25	Elaeocarpus reticulatus	N	0.1	1	G	
	26	Centella	N	0.1	20	G	
	27	Callistemon rigidus	N	1	3	M	
	28	Callistemon linearis	N	1	2	M	
	29	[illegible]	E	0.1	5	G	
	30	Glochidion	N	20	10	G	
	31	[illegible] sp.	N	0.5	100	G	✓
	32	Blackberry	HTE	0.1	10	G	
	33	Entolasia marginata	N	0.1	15	G	
	34	Petrophile pulchella	N	0.2	1	M	
	35	Hakea gibbosa	N	0.5	1	M	
	36	Hakea teretifolia	N	0.5	2	M	
	37	Whisky grass	E	0.1	5	G	
	38	[illegible]	N	0.1	10	G	
	39	microlaena	N	0.2	60	G	
	40	B- ericifolia	N	.5	8	G	

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); *Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Plot 1 sheet 2

-This document has not been endorsed or approved by Office of Environment and Heritage or Muddy Boots Environmental Training-

BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	/ /						
Zone	Datum	Plot ID		Plot dimensions		Photo #	
Easting	Northing	IBRA region		Midline bearing from 0 m		Magnetic?	
Vegetation Class						Confidence: H M L	
Plant Community Type				EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		Tally sheet

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300 …). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)						Bare ground cover (%)						Cryptogam cover (%)						Rock cover (%)					
Subplot score (% in each)	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f
Average of the 5 subplots																								

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify rat/ver/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date		Plot 1	

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Lomandra	E	0-1	5	G	
	2 Xanthorrhoea fibrosa	N	0-1	2	G	
	3 Setaria gracilis	E	0-1	10	G	
	4 Cynodon dactylon	E	0-1	1	G	
	5 Pennisetum clandestinum	E	0-1	10	G	
	6 Phoenix canariensis	E	0-1	1	G	
	7 Asparagus aethiopicus	E	0-1	5	G	
	8 Cynodon dactylon	E	0-2	10	L	
	9 Centrosema pubescens	E	0-1	1	G	
	10 Eragrostis brownii	N	0-1	5	G	
	11 A- Gahnia melanocarpa					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Plot 2 Sheet 1 (3)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date			

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
	1 (Lei 10)					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Plot 2 duet 2

BAM Site – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	_ _ / _ _ / _ _						
Zone _ _	Datum	Plot ID		Plot dimensions		Photo #	
Easting _ _ _ _ _ _	Northing _ _ _ _ _ _ _	IBRA region		Midline bearing from 0 m			Magnetic °
Vegetation Class							Confidence: H M L
Plant Community Type				EEC:			Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..... 100, 200, 300....). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots																				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Plot 2 Sheet 1 (3)

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BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	2/02/18	181 Allambie	Plot 2	GL DP			
Zone: 56H	Datum: GDA	Plot ID		Plot dimensions	50 x 20	Photo #	
Easting: 337015	Northing: 6263024	IBRA region	Sydney Basin	Midline bearing from 0 m	340° North (Magnetic)		
Vegetation Class						Confidence: H M L	
Plant Community Type	1824			EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		0
50 – 79 cm		
30 – 49 cm		
20 – 29 cm	11	
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	15 40 30 10 30	5 30 10 0 20	0 10 0 0 0	0 1 0 0 0
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover included leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern	gentle slope	Microrelief	
Lithology		Soil Surface Texture	Sandy	Soil Colour		Soil Depth	1-5 cm
Slope		Aspect	South	Site Drainage	to road	Distance to nearest water and type	1500m (dry)

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	3	R	APZ/fire clearing
Cultivation (inc. pasture)	0		
Soil erosion	0	1	
Firewood / CWD removal	0		
Grazing (identify native/exotic)	0		
Fire damage	1	0	some charring on bark
Storm damage	0		
Weediness	1		
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Plot 3 sheet 1 (5)

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BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	21/02/18	181 Allambie		LK DP			
Zone	Datum	Plot ID	3	Plot dimensions	50×20	Photo #	
56 H	WGS						
Easting	Northing	IBRA region	Sydney Basin	Midline bearing from 0 m	263° West		
337251	6263064						
Vegetation Class						Confidence: H M L	
Plant Community Type		1283		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		0
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30.... 100, 200, 300....). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	a b c d e	a b c d e	a b c d e	a b c d e
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern	veg, gentle slope	Microrelief	
Lithology		Soil Surface Texture	sandy	Soil Colour		Soil Depth	1cm
Slope		Aspect	South	Site Drainage	to hard drainage line	Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	2	R	mid layer involved
Cultivation (inc. pasture)	0		
Soil erosion	1	R	
Firewood / CWD removal	0		
Grazing (directly native/stock)	0		
Fire damage	1	NR	charred bark
Storm damage	0		
Weediness	0		
Other			

Severity: 0=no evidence, 1=slight, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Plot 3 Slent 1 (5)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date			

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	E- haemastoma	N	5	5	C	
	E- sieberi	N	2	2	C	
	A- crassifolia	N	35	10	M	
	L- glutinosa	N	10	15	C	
	E- capitellata	N	3	3	C	
	P- ferris	N	1	2	M	
	L- flavescens	N	5	10	M	
	Cyanthochloa depauperata	N	0-5	10	G	
	Themeda australis	N	0-5	10	G	
	L- obliqua	N	0.25	60	C	
	Glycine tabacina	N	1	50	G	
	Achyrotricha nitida	N	0-1	20	G	
	Veronica (lecifolia?)	N	1	10	G	✓
	L- sphaerica	N	5	15	M	
	Lomandra gracilis ?	N	0.1	20	G	
	Cyperaceae sp.	N	3	100	G	✓
	Lindsaea linearis	N	0.1	30	G	
	Leptospermum polygalifolium	N	2	20	G	
	Platysace	N	0.2	15	G	
	Amperea xiphoclada	N	2	20	G	
	B- ophiolica	N	3	10	M	
	H- lucifolia	N	2	5	M	
	Callistemon rigidus	N	1	2	M	
	D- oblong. 6b2	N	0-5	2	M	
	H- glabrata	N	2	5	M	
	L- parviflora	N	0.1	1	G	
	Lepto polygalifolium	N	1	5	M	
	Xanthorrhoea sp.	N	2	3	G	
	K- ambigua	N	2	5	M	
	M- dactyloides	N	0-5	2	M	
	Lomandra glauca	N	0.1	10	G	
	Hibbertia empetrifolia	N	0.1	2	V	
	Hibbertia linearis	N	0.1	5	G	
	B- serrulata	N	1	5	M	
	Persoonia levis/linearis	N	0.2	1	M	
	D- stricta	N	2	5	M	
	B- hemigenioides	N	1	3	M	
	Scaevola ramosissima	N	0.5	1	M	
	Epacris microphylla	N	0.1	5	G	
	Boronia pilosa	N	0.1	1	G	

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Eparia pulchella N 0.1 5 G pultenea ovata N 0.1 2 G

Hemigenia purpurea N 0.1 10 G ~~B - spinulosa~~

Plot 2 Quad 2 (4)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date			

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	Banksia ericifolia		3	15		
	Allocasuarina diogdistyla		2	5		
	Kunzea ambigua		20	200		
	Lepto trinervium		0.2	5		
	Angophora hispida		0.5	5		
	Lepto squarrosum		2	30		
	Hakea ~~dactyloides~~ teretifolia		0.2	2		
	micromyrtus ciliata - (beeka?)		0.3	100		
	Actinotus minor		0.2	100		
	Grevillea speciosa		0.2	10		
	Pultenaea elliptica		0.1	3		
	Lindsea linearis		<0.1	5		
	Xanthorrhoea resin?		0.1	1		
	Dampiera stricta		0.2	20		
	Caustis pentandra		0.5	150		
	Kunzea capitata		0.2	30		
	Hakea ~~dactyloides~~ Gibbosa		0.1	4		
	Cyanthocaeta dryandra		1	100		
	Banksia oblongifolia		0.3	3		
	Petrophile pulchella		0.2	10		
	Stylidium lineare?		0.1	30		
	Epacris microphylus		0.1			
	~~Hakea~~ Lepidosperma laterale		0.2	20		
	Persoonia lanceolata		0.1	1		
	Hibbertia aspera		0.1	2		
	Platysace linearifolia		0.3	20		
	Corymbia gummifera		5	4		
	Sedge ~ id		0.5	10		
	Epacris pulchella		0.5	10		
	Acacia suaveolens		<0.1	1		
	Crowea saligna		<0.1	1		
	Baurea ~~s~~ rubioides		0.2	5		
	Hemiandrus pungifolium		<0.1	1		
	Hemigenea purpurea		0.1	5	C	
	Lambertia formosa		0.1	1		
	Acacia ulicifolia		0.1	1		
	Lomandra ~~filiformis~~ gracilis		0.1	5		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ... 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Plot 3 Sheet 2 (6)

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BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	/ /						
Zone	Datum	Plot ID		Plot dimensions		Photo #	
Easting	Northing	IBRA region		Midline bearing from 0 m		Magnetic /	
Vegetation Class						Confidence: H M L	
Plant Community Type				EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Tally sprint	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30,.... 100, 200, 300....). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	70	90	100	100	100	30	10	–	–	–	–	–	–	–	–	–	–	–	–	–
Average of the 5 subplots																				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Plot 4 sheet 1

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 22.02.2018	Allambie	Plot 4	DP

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	Pyrrosia rupestris	N	2	100	G	
	Pellaea nitida	N	0.1	1	G	
	Lycopodiaceae spp.	N	30	1000	G	
	A. minor	N	0.2	200	G	
	D. emicifolia	N	5	15	G	
	L. squarrosum	N	50	50	M	
	Xanthorrhoea spp.	N	2	3	G	
	H. hirtifolia	N	3	15	M	
	L. polyantifolium	N	1	10	M	
	Microlaena stipoides (?)	N	0.1	20	G	
	Hardenbergia violacea	N	1	100	G	
	G. dryandroides	N	10	1000	M	
	A. longifolia	N	1	3	M	
	H. glabrata	N	2	10	M	
	C. gracilis	N	0.2	1	G	
	Poa	N				
	Entolasia spp.	N	0.1	5	G	
	Amphipogon strictus	N	0.1	2	G	
	Lomandra	N	0.2	2	G	
	Themeda australis	N	0.1	2	G	
	P. lanuginosa	N	0.1	1	G	
	A. stenophylla	N	0.5	2	M	
	D. oblongifolia	N	1	3	M	
	E. haemastoma	N	1	1	M	
	E. agrophylla ?	N	1	1	M	
	Hydrocotyle	N	0.1	5	G	
	Plantago	N	0.5	20	M	
	Dichondra	N	0.1	1	G	

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Plot 5 sheet 1 (8)

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BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	22/02/18	181 Allambie		DP			
Zone 56H	Datum MGA	Plot ID	Plot 5	Plot dimensions	20 x 50	Photo #	
Easting 337218	Northing 6262991	IBRA region	Sydney Basin	Midline bearing from 0 m	262° West		
Vegetation Class						Confidence: H M L	
Plant Community Type	1250			EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		0
50 – 79 cm		
30 – 49 cm		
20 – 29 cm	~20	
10 – 19 cm	~100	
5 – 9 cm	~120	
< 5 cm	~60	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	DNT	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	100 100 80 100 100	0 0 10 0 0	0 0 20 0 0	0 0 0 0 0
Average of the 5 subplots			5	

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern	Very Obvious	Microrelief	
Lithology		Soil Surface Texture	Sandy	Soil Colour		Soil Depth	2m
Slope		Aspect	South	Site Drainage		Distance to nearest water and type	< 100m Sand

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	3	R	fire break / track all mid Dog cut
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood / CWD removal	0		
Grazing (identify native/stock)	3		
Fire damage			
Storm damage	0		
Weediness	1	R	some lantana, adjacent to road track
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Plot 4 sheet 1 (7)

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BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	22/02/18	181 Allambie		DP			
Zone	Datum	Plot ID	Plot 4	Plot dimensions	50×20	Photo #	
56H	WGS						
Easting	Northing	IBRA region	Sydney basin	Midline bearing from 0 m	2° North	Magnetic?	
337189	6263053						
Vegetation Class						Confidence: H M L	
Plant Community Type		824		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		0
50 – 79 cm		
30 – 49 cm		
20 – 29 cm	1	
10 – 19 cm	~25	
5 – 9 cm	~80	
< 5 cm	1000+	n/a
Length of logs (m) (≥30 cm diameter, >50 cm in length)		

* Too dense to count

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30,..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	10	100	60	100	100	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots																				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element	mod slope	Landform Pattern		Microrelief	
Lithology		Soil Surface Texture	sandy	Soil Colour		Soil Depth	
Slope		Aspect	South	Site Drainage		Distance to nearest water and type	200m to 1st order drainage line

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	3	R	APZ(?) / Path cleared through centre
Cultivation (inc. pasture)	0		
Soil erosion	1	R	
Firewood / CWD removal	0		
Grazing (density native/stock)	0		
Fire damage	1	NR	slight charring, old growth
Storm damage	0		
Weediness	0		
Other			strip down middle cleared

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Plot 5 Sheet 1 (8)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 22 02 2011	181 Allambie	Plot 5	DP

GF Code	Top 3 native species in each growth form group. Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	L. adiantifolium	N	50	100	M	
	H. glaberrima	N	15	30	M	
	Lomandra longifolia	HTE	1	10	L	✓
	Cyperaceae sp.	N	15	100	L	
	Imperata cylindrica	N	0.5	20	L	
	Xanthorrhoea sp.	N	2	3	L	
	Blechnum patersonii	N	3	25	L	
	Pittosporum undulatum	N	0-5	1	M	
	A. longifolia	N	1	10	M	
	E. pilularis	N	5	25	C	
	E. sieberi	N	25	25	C	
	D. sericea	N	5	8	M	
	E. globoidea	N	3	5	C	
	Cheilanthes sp.	N	1	2	C	
	A. parramattensis	N	0.5	1	M	
	Entolasia sp.	N	0-5	50	C	
	Andropogon	N	5	30	C	
	Cassytha	N	0-1	2	V	
	Lomandra hystrix dyandra	N	10	100	C	
	Oxalis	E	0-1	1	L	
	Lomandra	N	0-5	10	C	
	Hardenbergia violacea	N	0-1	1	L	
	Lomandra longifolia	N	0-5	25	C	
	Senna	E	0-1	1	L	
	Billardiera scandens	N	0-1	1	L	
	L. obliqua	N	0-1	5	C	
	Lomandra	N	1	5	AC	
	B. oblongifolia	N	1	5	M	
	B. ericifolia	N	3	20	M	
	Platysace	N	0-1	3	C	
	E. haemastoma	N	3	1	C	
	A. linearis	N	0-2	20	C	
	Banksia unbonata	N	0-1	1	C	
	A. sarmentosa	N	0-5	3	M	
	A. crassifolia	N	0-1	5	C	
	L. obliqua	N	0-1	25	C	
	Pandorea pandorana	N	0-1	1	C	
	Parsonsia straminea	N	0-1	2	C	
	Lomandra longifolia	N	0-2	50	C	
	L. spicata	N	1	10	M	

GF Code: see Growth form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3. ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Plot 5 sheet 2 (1)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date			

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 [illegible]	N	1	100	G	
	2 [illegible] glycine	N	0.1	2	G	
	3 [illegible]	N	1	100	G	
	4 [illegible]	N	0.1	1	G	
	5 [illegible]	N	0.1	1	G	
	6 [illegible]	N	0.1	2	G	
	7					
	8					
	9					
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	11					
	12					
	13					
	14					
	15					
	16					
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	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Plot 5 Sheet 2 (9)

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BAM Site – Field Survey Form Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	/ /						
Zone	Datum	Plot ID		Plot dimensions		Photo #	
Easting	Northing	IBRA region		Midline bearing from 0 m			
Vegetation Class						Confidence: H M L	
Plant Community Type				EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30.... 100, 200, 300....). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	a b c d e	a b c d e	a b c d e	a b c d e
Average of the 5 subplots				

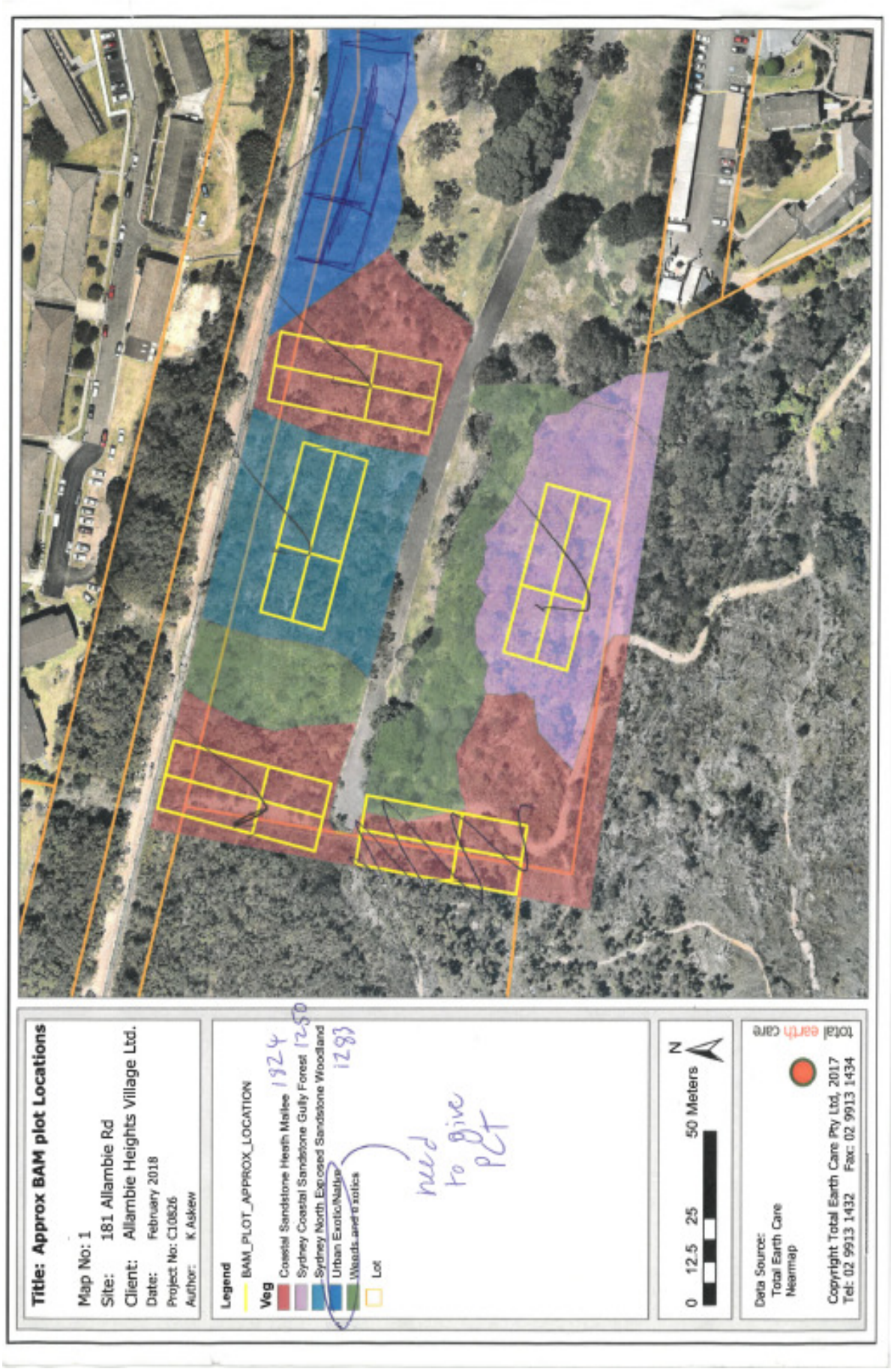
Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)


Title: Approx BAM plot Locations
Map No: 1
Site: 181 Allambie Rd
Client: Allambie Heights Village Ltd.
Date: February 2018
Project No: C10826
Author: K Askew
Legend
BAM_PLOT_APPROX_LOCATION
Veg
Coastal Sandstone Heath Mallee
Sydney Coastal Sandstone Gully Forest
Sydney North Exposed Sandstone Woodland
Urban Exotic/Native
Weeds and exotics
Lot
1924
1250
1293
need to give PCT
0 12.5 25 50 Meters
N
Data Source:
Total Earth Care
Nearmap
total earth care
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